SCIENTIFIC AMERICAN

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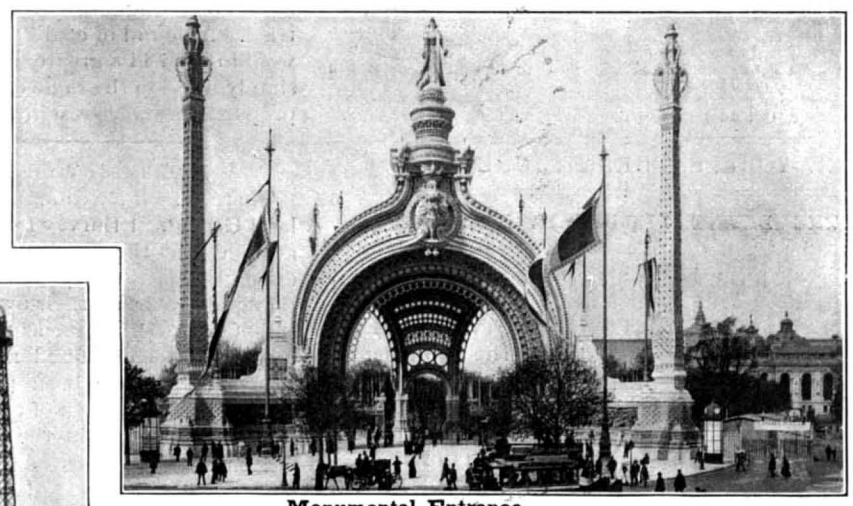
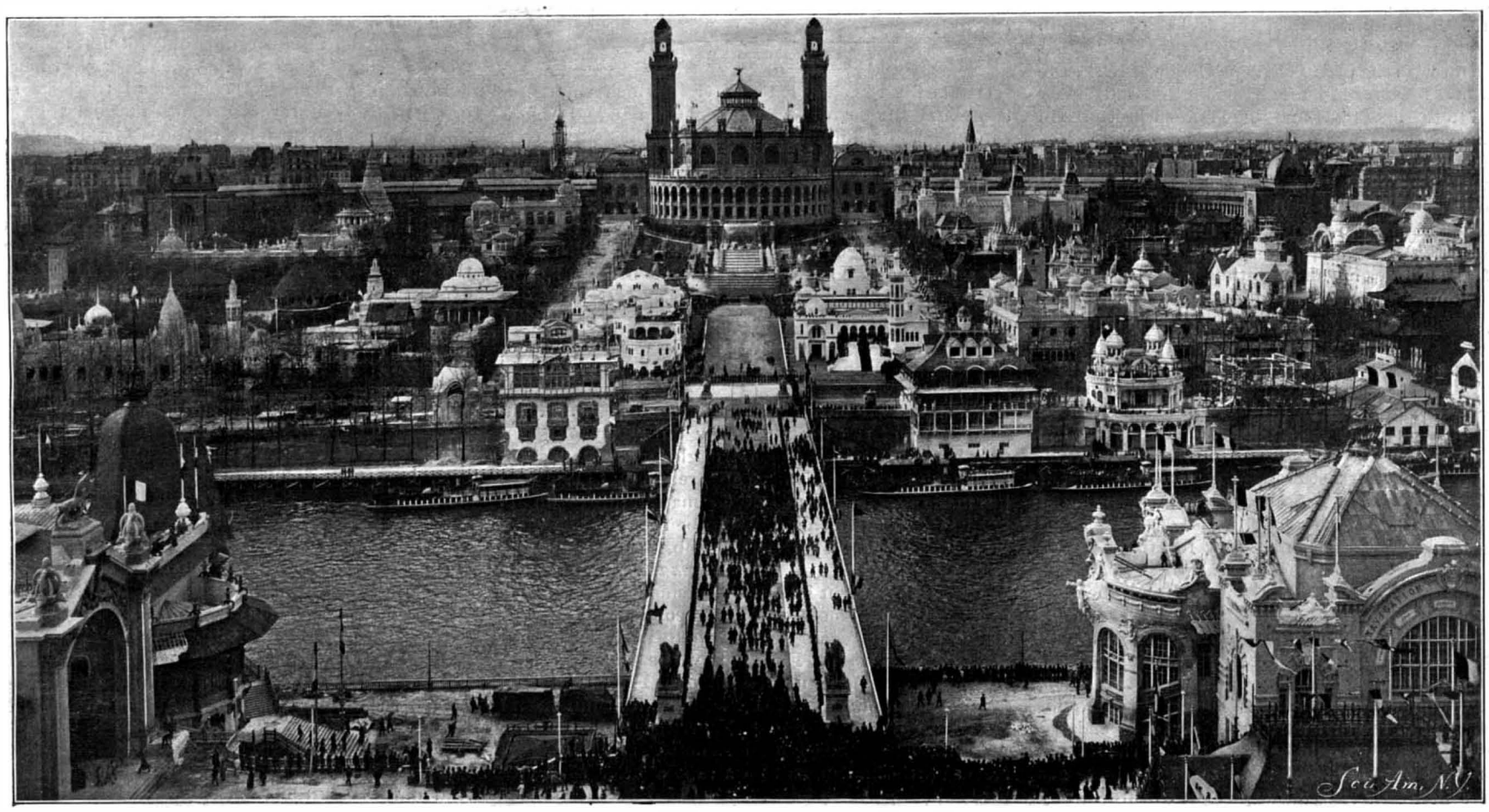
Champ de Mars Section During the Inauguration.



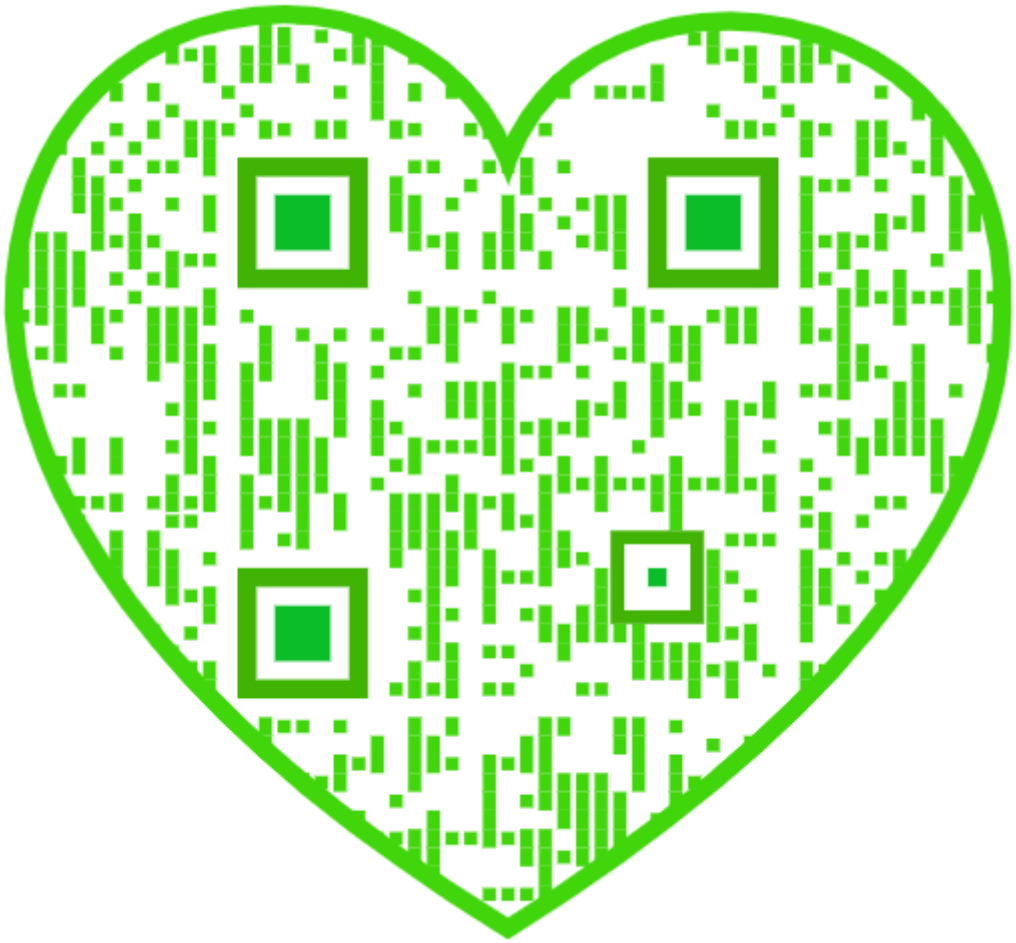
Monumental Entrance.

General View of the Champ de Mars Section from the Trocadero.



The Trocadero Section from the Champ de Mars.

SOME PERSPECTIVES OF THE PARIS EXPOSITION.—[See page 406.]



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NEW YORK, SATURDAY, JUNE 30, 1900.

THE LATEST LIQUID AIR FALLACY.

Our readers will doubtless remember that about a year ago, when the liquid air craze was at its height, we published (SCIENTIFIC AMERICAN, April 22, 1899) a characteristic article from the pen of President Morton, of the Stevens Institute, exposing the fundamental fallacies underlying the claims which were being made for liquid air. This and other *exposés* that appeared in the contemporary technical press of the country went far to neutralize the pernicious effects of the liquid air promotion that was then rampant. After a period of comparative quiet, the public is again deluged with prospectus literature of the kind that is unfortunately only too successful in emptying the purse of the half-informed and all-too-easily-deluded investor.

The present exploitation, however, is being carried out under a new name, and with promises of profit that are as alluring as the most exacting prospectus-writer could demand. Liquid air no longer parades as a perennial source of motive power whose volume, so far from diminishing, grows larger the more we take from it; and as representing an inexhaustible source of refrigeration it has evidently lost its drawing power. We are now told, indeed, that it is to liquid air that we must look as our most profitable source of heat. Its oxygen is to be extracted, bottled up, and used in our steamships, locomotives and reducing furnaces in such magical fashion as to produce the usual "revolution" in the field of transportation and manufacture. This latest fallacy has been exposed in the very convincing article by President Morton, which, by the courtesy of The Stevens Indicator, we are enabled to reproduce in full in the current issue of the SUPPLEMENT.

The latest claim of the promoters is that, by distilling off its nitrogen, liquid air may be utilized as a means of producing oxygen gas in large quantities and at a relatively low cost. While it is admitted that pure oxygen could be obtained cheaply in this way. President Morton shows that as it costs, according to Mr. Tripler, twenty cents to produce a gallon of liquid air, and as it requires five gallons of liquid air to produce one gallon of oxygen, the cost of production must be one dollar per gallon, or about ten dollars per thousand cubic feet at atmospheric temperature and pressure. It is admitted that this is less costly than the present methods, but it is pertinently asked, "What shall we do with the cheap oxygen when we get it, the present uses for oxygen being very limited and chiefly confined to the lime light and some refined processes in metallurgy?"

The liquid air prospectus tells us that the oxygen is to be used as a substitute for air in the ordinary processes of combustion, as under steam boilers, in iron furnaces, and the like; but used under these conditions it would be in competition with free air, and the cost of the storage or transportation, as the case might be, would be altogether prohibitory. It is argued that the most conclusive way to test the value of this suggestion is to reduce it to a concrete case, with actually calculated proportions of parts, volumes and weights; and because the necessary data is easily obtained, President Morton takes as his text the case of a large transatlantic steamer. He argues that since every ton of coal requires 2½ tons of oxygen for its consumption, and as it takes about 2,000 tons of coal to carry one of these ships across the Atlantic, the transportation in storage cylinders of the 5,000 tons of compressed oxygen thus shown to be necessary for the combustion of the coal, would reduce the carrying capacity of the ship to practically nothing, the coal and the compressed oxygen aggregating a dead load of 7,000 tons, to say nothing of the weight of the storage cylinders.

If the gas were not compressed, each ton of coal would require 66,000 cubic feet of gas, and the whole 2,000 tons would require 132,000,000 cubic feet. Even if forty per cent of the fuel were to be saved, as claimed by the promoters, it would be necessary for the ship to carry twenty-two tanks of the size of the huge gas holders which form such a conspicuous feature in any distant view of New York city.

Your promoter, however, is nothing if he is not ready-witted, and he will, of course, suggest that the idea of storage was never in his mind, and that each vessel would carry the oxygen-manufacturing plant on board, and would make the gas as it was needed. It is sufficient to say that the necessary plant to produce the 1,250 tons of oxygen which would be needed per day for the 500 tons of coal consumed daily in the furnaces of the steamship "Campania" would call for boilers and engines that would rival in bulk and weight the engines and boilers that propel the ship.

Lastly, attention is drawn to the fact that the enormous intensity of the temperature produced by the combustion of fuels in oxygen would lead to the burning and melting down of the furnaces in which it was tried. A pound of coal burnt under these conditions would not yield a greater quantity of heat, but would simply develop the same quantity in less time, with a proportionate increase in the intensity of the heat.

ECONOMIC VALUE OF GOOD ROADS.

There is food for thought in the report of the Maryland Geological Survey for 1899. In the first place we are told that the people of Maryland have expended, during the last ten years, upon the so-called construction and repair of their own roads, the sum of no less than $6,000,000. It seems that the greater part of this money has been frittered away in the attempt to repair roads which have been poorly laid out in the first place, and for the lack of certain necessary engineering qualifications can, in the nature of things, never be made into good roads. As an instance of this it may be mentioned that many of the common roads have no natural drainage. We are told that most of them are in a poor condition for a part of the year, and some of them for the whole twelve months.

As the result of a careful estimate made by the survey, it is shown that the farmers of the State of Maryland expend $3,000,000 a year more on their hauling over the present poorly built highways than would be necessary if the hauling were done on first-class roads. These figures are to be compared with the information collected by the Department of Agriculture in 1895, when, as the result of data received from over twelve hundred counties in various parts of the United States, it was ascertained that the average cost of hauling one ton for one mile over country roads was twenty-five cents; which was just three times as much as the average cost of hauling over the improved macadam roads of six European countries. If this large sum of money represents the loss to the State of Maryland from poor roads, it is easy to say that the total loss throughout the whole United States represents a figure so great that it must have an important bearing upon the prosperity of the country at large, and particularly upon the farming interests as such.

At first sight it seems incredible that in a country so progressive as ours the condition of the common roads should be over a half century behind that of the old world. It is true that the vast extent of the United States, and the great mileage of our roads in some States relative to the density of the population, may be offered as an excuse for our backwardness; but while this plea may hold good as regards the thinly populated Western and Southern States it cannot be applied to the older, more populous and wealthy sections of the country.

COMMERCIAL EXPANSION AS A SCIENCE.

Our last issue contained a letter in which the writer contrasted the business methods of German and American merchants, and proved how, in many ways, Germans showed more business sagacity in dealings with South American firms. According to our correspondent, the secrets of German success are not far to seek. The inability of many American commercial travelers to speak the language of the country to which they are sent; the elaborate American price lists and catalogues, with their complex and useless system of discounts from list prices; the refusal to extend credit; and the inability or unwillingness to humor the customer, go far to offset the superior quality of American goods.

But there are still other reasons why Germany in many parts of the world is slowly but surely outstripping her sister nations in the struggle for commercial supremacy—reasons which are apparent only to him who has made a careful study of German industry on its native heath. Such a study is to be found in the work of a Frenchman, Maurice Schwob, which bears the dramatic title, "*Le Danger Allemand.*" The book has forcibly brought home to Frenchmen the necessity of very radically modifying their commercial system, if they desire to regain even a tithe of what they have lost in foreign trade. Fortunately, the American business man is far more energetic than his French *confrère* for which reason Schwob's criticisms of his countrymen can hardly be applied to us. Nevertheless, his analysis of German methods is so instructive, is based upon facts so little known, as to warrant a brief review of his book.

"The German Danger" is discussed by Schwob in five sections—"The Sea Danger," "The Industrial Danger," "The German System," "German Advertising," and "The Conquest of Markets."

"The Sea Danger" for France lies in the decline of the shipping interests of her ports. Besides the successful competition of Hamburg with Liverpool, Schwob notices the development in shipping at Antwerp and Rotterdam, both of which cities owe their unexpected commercial good fortune to the fact that they are outlet ports for the Rhine, by which the products of Frankfort, Mannheim, Mayence, Düsseldorf, and other river towns are transported to the sea. The benefits to be derived by shipping to Antwerp were found to be so advantageous to Frenchmen that the head of the Department of Meurthe-Moselle stated that not only was a part of France thus annexed to Belgium, but that Germany and Belgium together threatened commercially to incorporate the whole of France.

"The Industrial Danger" has also given Schwob much concern. The German government, he finds, understands thoroughly the making of commercial treaties which enable home industries to thrive despite the keenest foreign competition. The revenues obtained from the taxing of imports are not all swallowed by the national treasury; but a certain part of the money received is paid out as premiums for the exportation of German goods. The bureaucratic political system of France, says Schwob, renders a co-operation of the government authorities and merchants impossible. Tariff systems are made and unmade in a day. Laws, ill timed and badly framed, go into effect, which, although designed to check foreign invasion, really cripple French industries. Officials are "politicians" in the very sinister sense which that much-abused word has acquired in the United States. In Germany, on the other hand, the government and the merchants work in harmony. Bills are introduced and passed in the Reichstag exactly when they are most needed, and are so broad in their scope that the hands of the exporting manufacturer cannot be tied by official red tape. Schwob cites a striking example of this intelligent co-operation. For years, German shipbuilders had been purchasing their iron and steel from English foundries. At a convention of German ironmongers and shipbuilders, it was decided that German foundries were thereafter to deliver the steel required by the shipbuilders. It was found necessary to reduce the railway freight-charges on iron; the government immediately provided lower rates, "of its own accord" (*spontanément*), writes Schwob maliciously, for in France the officials rarely act "*spontanément.*" And the shipbuilders agreed to pay from three to five per cent more for German than English iron, in order that the home industry might flourish. No protective tariff was established.

Germany's method of "conquering markets" is due primarily to the "floating expositions" sent to all parts of the world. A syndicate of merchants charters a steamer, loads her with goods carefully selected for foreign buyers, sends her from port to port, in accordance with a schedule prepared with characteristic German attention to detail. Representatives of the firms are sent ashore at the various cities. Each man speaks the language of the country fluently; he studies the needs of the population; he distributes samples and intelligently compiled catalogues, and takes orders for goods; in a word, he does everything in his power to further the interests, not only of his firm, but of German commerce as well. When his report has been handed in, a swarm of commercial travelers settles down in the country visited, all of them thoroughly familiar with the business methods of the people, and ready to build on the foundations laid by their predecessor.

Second in importance only to the "floating expositions" are the export associations that, for the last ten years, have maintained trade museums or bazaars for the purpose of exhibiting their wares, and for sending expeditions to all parts of the world, in order to accustom the people to the use of German products, to distribute catalogues of samples, lists of export houses and the goods sold by each. Is it any wonder that one can pick up everywhere so many articles of manufacture that bear the familiar inscription "Made in Germany"? Is it any wonder that not only Africa and South America and the countries of the Orient have been thus commercially conquered by the "indomitable German," but also Norway, Denmark, Holland and Russia—"countries," says Schwob, "that are our friends, and hate and fear Germany."

Although it is primarily intended for his countrymen, Schwob's study contains many a lesson by which American merchants may well profit. Our exports, it is true, have never been so large as in the last ten years; and at the close of each year the records show that there is not a single branch of industrial activity in which we have not made some progress. What we have gained has been gained not so much by concerted action as by the efforts of individual firms. Our progress has been great; but it should be still greater. And only by systematic aggression, by the establishment of more institutions similar to the Philadelphia Commercial Museum, and by arranging more exposi-

tions like the Pan-American Exposition, to be held in 1901, can we hope to compete with the German in markets which he hopes some day to consider exclusively as his own.

ROBERT SIMPSON WOODWARD.

BY MARCUS BENJAMIN, PH.D.

After an absence of thirteen years the American Association for the Advancement of Science returns to New York and will hold its forty-ninth meeting in this city during the week beginning with June 25.

In 1887, Dr. Samuel P. Langley, the secretary of the Smithsonian Institution, presided over the meeting, succeeding on that occasion Edward S. Morse, the director of the Peabody Academy of Science, in Salem, Mass. For this meeting Robert S. Woodward has been chosen to preside, and he will succeed Grove K. Gilbert, of the United States Geological Survey, who was elected last December to fill the unexpired term of the late Edward Orton, a sketch of whom appeared in the SCIENTIFIC AMERICAN for August 18, 1899.

Prof. Woodward was born in Rochester, Mich., on July 21, 1849. Loyal to the State of his birth, he entered the University of Michigan, in Ann Arbor, and was graduated there in 1872 with the degree of Civil Engineer. An appointment as assistant engineer in the United States Lake Survey was offered to him, and for ten years he continued in that service.

In 1882, he resigned from the Lake Survey to become astronomer on the United States Transit of Venus Commission. Two years later he passed to the service of the United States Geological Survey with which he remained for six years, serving in the successive capacities of astronomer, geographer, and chief geographer. He then became an assistant in the United States Coast Survey, with which he continued for three years.

The death of Prof. William P. Trowbridge, in 1892, created a vacancy in the scientific faculty of Columbia University that at first sight seemed almost impossible to fill, and indeed the department over which he had charge was so extended that the difficulty was only met by dividing his chair into several co-ordinate professorships. To that which was designated as Mechanics, Prof. Woodward was called, he having gained his professorial title by filling, during 1886–88, the chair of civil engineering in the Corcoran Scientific School of Columbian University in Washington, D. C., where he acquired much reputation by his success as a teacher.

The choice of the trustees proved a wise one, for with the growth of the college into a university, additional duties have been assigned to Prof. Woodward in the accomplishments of which he has shown exceptional ability. It is not necessary to enumerate the various offices that he holds in connection with Columbia, and they are many, for the most important is that of Dean of the School of Pure Science, which he has filled since 1895, and it is sufficient to show the high esteem in which he is held by his associates.

His scientific work has included numerous contributions in the domains of precise mensuration, geodesy, the physics of the earth, physical astronomy, and pure mathematics, and of the hundred or more titles of papers that he has published the following are the more important: "On the Actual and Probable Errors of Interpolated Values from Numerical Tables by Means of First Differences" (1882); "Results of Experiment to Determine the Variations in Length of Certain Bars at the Temperature of Melting Ice" (1883); "On Errors Incident to Interpolated Values from Numerical Tables" (1886); "On the Free Cooling of a Homogeneous Sphere" (1887); "On the Conditioned Cooling and Cubical Contraction of a Homogeneous Sphere" (1887); "On the Diffusion of Heat in Homogeneous Rectangular Masses, with Special Reference to Bars Used as Standards of Length" (1887); "On the Form and Position of the Sea Level" (1888); "The Effects of the Atmosphere and Oceans on the Secular Cooling of the Earth" (1890); "Recent Experience of the United States Coast and Geodetic Survey in the Use of Long Steel Tapes for Measuring Base Lines" (1893); "The Iced Bar and Long Tape Base Apparatus, and the Results of Measures made with them on the Holton and St. Albans Bases" (1892); "An Historical Survey of the Science of Mechanics" (1894); and "Mechanical Interpretation of the Variations of Latitudes" (1895); and in book form the "Smithsonian Geographical Tables" (1894), a volume of nearly three hundred pages, published by the Smithsonian Institution.

The degree of Ph.D. was conferred on him by his Alma Mater in 1892, and in 1896 he was chosen to membership in the National Academy of Sciences. For more than ten years he has been an associate editor of The Annals of Mathematics; and since 1894 he has been an associate editor of Science; also, he is one of the editorial corps of The Columbia Quarterly.

The American Mathematical Society has honored him by successive elections to the offices of treasurer, vice-president, and president, and he is now president of the New York Academy of Sciences.

He joined the American Association for the Advancement of Science, at its Philadelphia meeting held in 1884, and a few years later was elected to the vice-presidency over the section of Mathematics and Astronomy; delivering an address at the Toronto Meeting in 1889, on "The Mathematic Theories of the Earth," which attracted considerable attention and was largely reprinted in the scientific journals of this country. In 1894, he was chosen treasurer of the association, an office which he still holds. Prof. Woodward has on several occasions been urged for the presidency of the association and would have been elected at the Boston meeting two years ago had he not gracefully withdrawn in favor of Prof. Edward Orton.

Applied Mathematics has no more distinguished representative in this country than Prof. Woodward, and the association has honored itself by choosing its most loyal member in that branch of science to preside over its sessions to be held in this city.

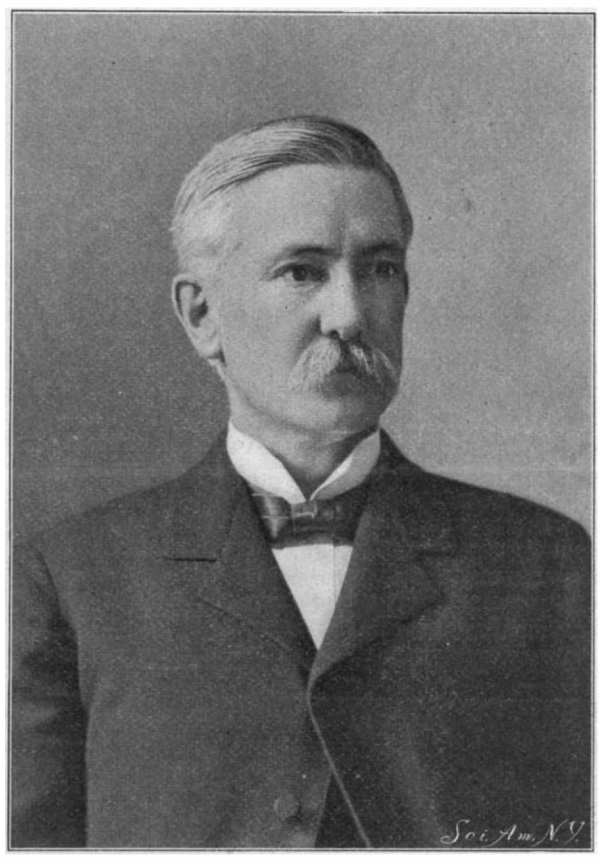
THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH D.

Astronomers have never had less occasion to complain of the weather than on the 28th of last May. All along the eclipse tracks, from the Gulf of Mexico to Northern Africa, cloudless skies were the rule, and no one seems to have been unable to see the sun.

But for this very reason, it will be some time before the results of the day's observations are fully known. At the time of writing it is hardly probable that all the eclipse plates have been developed, and their measurement and reduction, especially in the case of those of the spectrum, and those made in the search for a possible intra-mercurial planet, will take a lone time.

The present statement must, therefore, deal simply with some of the results obtained by the Princeton University party stationed at Wadesboro, N. C.



ROBERT SIMPSON WOODWARD.

The eclipse was an unusually bright one, a great deal of light being diffused into the shadow from the illuminated air outside its limits, so that only first magnitude stars were visible, and it would have been perfectly easy to read an ordinary watch face during totality.

The observations of the corona and lower layers of the sun's atmosphere showed that the sun's surroundings were in a decidedly quiescent state. The flash spectrum was faint, and the prominences relatively few—only one being large—while the unknown gas which produce the green line in the spectrum of the corona was conspicuous by its absence, being too faint to be seen or photographed at all, and disappointing those who tried to observe it.

The form of the corona was very close to that predicted by Hansley, showing long equatorial extensions and short curved rays near the poles.

The inner corona showed very little telescopic structure, with no conspicuous evidence of connection with the prominences.

The shadow bands, which appear just before and after totality, were well seen. They moved in different directions at the stations only a short distance apart—a circumstance which strongly supports the theory that they originate in the earth's atmosphere.

About fifteen good negatives of the corona were obtained with instruments up to 12 feet focal length. Those, with exposure of 20 seconds, show extensions of the corona considerably more than the sun's diameter in length.

THE HEAVENS.

At 10 P. M. on July 15, the constellations of summer are visible to great advantage.

The Milky Way forms a great arch across the east, with one foot almost under the pole and the other in the extreme south; and along its line are the constellations described last month.

The present is a good time to note the complex structure of the Galaxy. From Cygnus to the southern horizon it is divided into two streams of unequal brightness and variable width, with several marked condensations and knots, of which the brightest are in Sagittarius, near the southern horizon.

In the northwest appears the Great Bear, standing on his head, and the west is lighted by Arcturus and Spica, the latter being near its setting. The southern constellation Scorpio and Sagittarius are at their highest above our horizon. Scorpio is identified by the presence of Jupiter within its borders, and Sagittarius by the fainter and yellower Saturn and also by the little group of stars called the Milky Dipper, which, though it is in the Milky Way, must always be empty, for it is wrong side up.

In the southeast is a pair of moderately bright stars close together which is worth looking at. They are Alpha and Beta Capricorni and are both double. Alpha—the upper one—has a close companion on the right and a fainter and more remote one on the left. Both are visible to a good eye without a glass. Beta shows in a field glass a still closer companion of the seventh magnitude. With the telescope the stars are much more remarkable. The companions of both Alpha and Beta are double in powerful telescopes, and the companion of Alpha is separated by the most powerful instruments into two stars!

THE PLANETS.

Mercury is in Cancer, and is evening star till the last day of July, setting nearly two hours after the sun on the 1st and easily visible in the evening twilight. On the 31st he is in inferior conjunction with the sun and becomes a morning star again.

Venus is the evening star at the beginning of the month, but sets only ¾ of an hour after sunset, and rapidly approaches the sun, passing inferior conjunction on the 7th. As she passes south of the sun she will be invisible to the unaided eye till late in the month, when she reappears as morning star, and rises about an hour before the sun on August 1. Those who have telescopes may follow with interest the narrowing of her crescent, and may, perhaps, see its extension beyond the half of her circumference, due to twilight in her atmosphere.

Mars is being slowly overtaken by the earth, but is still far from opposition. He moves eastward through Taurus during the month and rises between two and three hours before the sun.

Jupiter is in Scorpio, and is well up in the southeast at sunset. The belts on his surface and his satellites are beautiful objects in the smallest telescope. To aid the identification of the outer two, last months list of their positions is continued.

Satellite III. will be east of Jupiter on the 1st, 8th, 15th, 22d and 29th, and west on the 4th, 11th, 18th and 25th.

Satellite IV. will be east on the 6th and 23d, and west on the 15th and 31st.

Saturn is just past opposition and is visible throughout the night, but as he is as far south as possible and at his greatest distance from the sun the present opposition is very unfavorable.

He figures, however, in the most interesting astronomical event of the month, for American observers—an occultation on the 10th visible throughout the United States.

As in the case of a solar eclipse and for the same reason, the time of the phenomenon is different at different places. At Washington Saturn disappears behind the moon's dark limb at 10:43 P.M., and reappears at 12:05 A.M. from behind the bright limb.

The local time of occultation will be about an hour earlier in the Middle West, and two hours earlier on the Pacific Coast. It will take about a minute and a half for the moon to hide the planet, so that the gradual character of the decrease of its light will be evident to the naked eye, while with the telescope the spectacle of the moon's dark limb slowly and steadily hiding the rings and ball of the planet will be one of uncommon interest.

Uranus is in Scorpio east of Jupiter, and Neptune is too near the sun to be seen.

THE MOON.

First quarter occurs on the night of the 4th, full moon on the afternoon of the 12th, last quarter on the morning of the 19th, and new moon on the afternoon of the 26th. The moon is farthest from the earth on the 3d and again on the 31st, and nearest on the 15th.

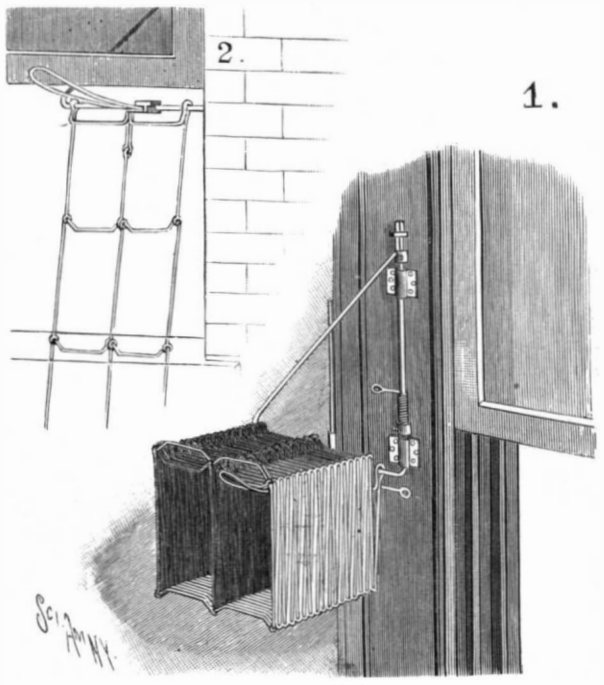
In addition to the occultation of Saturn there should be noted conjunctions of the moon with Jupiter on the afternoon of the 8th, Uranus the following morning, Mars on the afternoon of the 22d, Neptune on that of the 23d, Venus on the forenoon of the 24th and Mercury on the night of the 26th.

Princeton University Observatory.

A SELF-LAUNCHING FIRE-LADDER.

Our illustrations picture a very ingenious and inexpensive fire-ladder, invented by Mr. Theron N. Parker, of 226 North Ninth Street, Brooklyn, New York city, which ladder is so arranged that by releasing a retaining device, it will be automatically thrown out of an open window into the street.

Held in bearings at the side of the window, well above the head of a person, is a bracket in the form of a right-angled triangle. The base of this triangular bracket carries a steel loop which supports the folded steel ladder, made in any desired length. In order to



THE LADDER FOLDED AND LAUNCHED.

reinforce the loop, and to hold it in substantially horizontal position, a vertical brace is employed, extending upwardly behind and in contact with the hypotenuse of the triangle. The vertical member of the triangular bracket, journaled in the bearings, is surrounded by a powerful coiled spring, the upper end of which is extended laterally to form a stop, which limits the inward motion of the bracket. A fastening device which can be released by a pull-cord, lever, or electric push-button is provided for the base of the bracket.

When the fastening device is released, the strong steel spring instantly swings the bracket through a semicircle to the open window, with such speed that the momentum acquired launches the fire-ladder into the street, so that it hangs as shown in our illustration.

Not the least interesting feature of this simple device is the construction of the ladder. It will be observed that side runs are employed, between which, rungs extend, having offset portions serving as footholds. So compact is this ladder, that a length equivalent to five stories can be packed in less than a cubic foot of space. The ladder is light; for it weighs but two pounds to the story. It is strong; for the severe tests to which it has been subjected have shown that it is capable of supporting a weight of one thousand pounds with perfect safety, and without any possibility of entangling. When the ladder is launched by means of the push-button or lever, a strong, trustworthy escape is formed for each floor in the line of the windows—an escape by which firemen, if necessary, can ascend to any floor. The bracket, it is evident, can be quickly placed in position on any window.

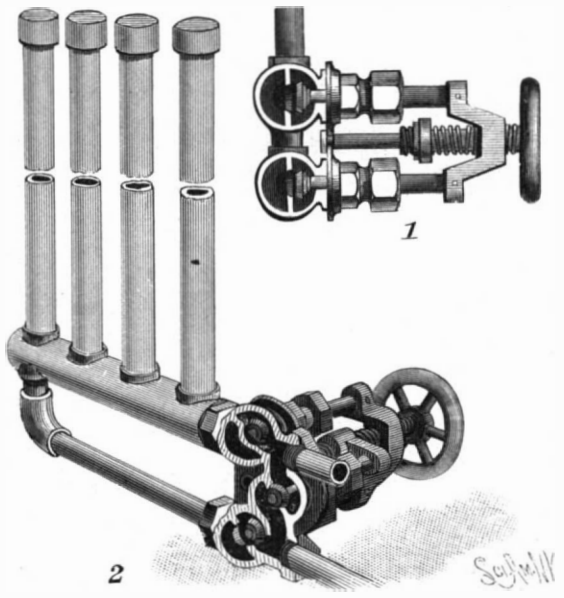
THERE is a project for another subway in Boston, to connect under Washington Street with the present subway, and the one to East Boston, on which work was started a few weeks ago, has been laid aside for a year at least, says The Western Electrician. The matter has been the subject of many petitions and much remonstrance, and the committee on metropolitan affairs in the legislature voted to refer the bill to the next General Court.

AN IMPROVED VALVE FOR STEAM RADIATORS.

An invention has been patented by Mr. Timothy S. Martin, of Butte, Mont., which provides a simple valve mechanism particularly adapted for use on radiators through which exhaust steam is passed, and designed to reduce back pressure against the engine. Fig. 1 is a central sectional elevation of the invention with parts broken away. Fig. 2 is a perspective view, also with parts broken away.

The radiator is constructed with the usual upright tubes connected with upper and lower horizontal circulating-tubes. At the end of the circulating-tubes, a valve casing is located, comprising two chambers, which can be connected with the steam-supply. A central apertured partition separates the chambers. The casing has also two outer chambers and two outer apertured partitions, one between each outer chamber and the adjacent chamber connected with the steam supply. A central valve is arranged to open and close the aperture in the central partition; and two lateral valves are arranged to close the apertures in the outer partitions. A cross-head connects the outer valves and has a screw-threaded aperture. A head connected with the central valve has an aperture with a screw-thread of a direction opposite to that of the cross-head, the two threaded apertures being alined axially. A valve-operating shaft is mounted to turn in the casing, but is held against longitudinal movement, and is provided with screw-threads of opposite directions engaging the oppositely threaded apertures of the heads.

When the center valve is closed, the outer valves are opened (Fig. 1), so that the steam enters one of the circulating-pipes, passes through the outer chamber and open partitions to the radiator and returns through the other circulating pipe. If the center valve be opened by turning the shaft previously mentioned, the inlets to the radiator will be closed, and steam will not enter the radiator. It is evident that under these conditions the steam will not encounter a solid, closed valve, as in the customary construction, but will pass through the valve-casing and back to the boiler, thereby obviating the back pressure usually caused by cutting off the steam at the radiator.



THE MARTIN RADIATOR VALVE.

EXAMINATION OF THE DRINKING WATER OF BROOKLYN, NEW YORK.

The advances in sanitary science in the past few years are nowhere more marked than in water examination. The splendid work done by the Massachusetts State Board of Health has been followed by the installation of laboratories in most of our American cities for the examination of the water furnished by the municipality. It is naturally understood that departments of water supply should be responsible for the quality, as well as the quantity, of water furnished. This demands a constant knowledge of the sanitary condition of the water supply, which can be attained only by frequent analyses and inspection.

The water supply of Brooklyn is complicated, and the need of a laboratory was apparent to the Department of Water Supply for several years. In 1897, Mr. George C. Whipple, Associate Member of the American Society of Civil Engineers and author of several works upon sanitary water supply and examination, was appointed biologist and director. The old gate-house on the Mount Prospect reservoir was found to have ample accommodations, and it was remodeled to meet the peculiar conditions of a chemical and biological laboratory. In the SUPPLEMENT for the current week there is a very full paper upon the Mount Prospect laboratory, presented by Mr. Whipple before the Brooklyn Engineers' Club. It deals with the collection of samples and with the work carried on, and to this article we refer our readers who desire more extended information on the subject.

The laboratory occupies the upper portion of the building and is divided into three rooms. One room is known as the general laboratory, the second the biological laboratory, and the third the chemical laboratory. In the basement is a physical laboratory, storeroom, etc., and there is a sub-basement suitable for bacteriological work during hot weather. The laboratories are equipped with the latest apparatus known to science, including ice chests for the storage of culture media, incubators, sterilizers, balances, desiccators, steam baths, stills for ammonia distillation, Sedgwick-Rafter filters, a combustion furnace, a Mahler bomb-calorimeter, etc. The laboratory force consists of one biologist and director, one chemist, one assistant chemist and three assistants. The routine work consists of the regular examination of the samples of water received from all parts of the watershed and distribution system, i. e., from the driven wells, streams, ponds, aqueducts, reservoirs, etc. The complicated and varied character of the water supply requires the examination of an unusually large number of samples, and it is safe to say that no water supply in this country is examined more thoroughly and minutely than that of Brooklyn.

THE CHEMICAL LABORATORY OF THE MOUNT PROSPECT LABORATORY FOR THE BIOLOGICAL AND CHEMICAL ANALYSIS OF BROOKLYN'S DRINKING WATER.

The regular routine includes the bacteriological examination of three samples of water from the Ridgewood pumping station and from a tap in the city collected daily; a complete physical, chemical and biological examination of nine samples from the distribution system collected weekly; the physical, biological and partial chemical examination of twenty-four samples from the supply ponds collected weekly, with complete chemical analyses monthly; the complete examination of nineteen samples from driven wells collected monthly; and the complete examination of twenty-one samples from the private water supply companies of Brooklyn and from the water supply of the Borough of Queens collected quarterly. Many extra samples are taken at various times and places as occasion requires.

The samples of water from the watershed are collected in the forenoon during the early part of each week, and are sent to the laboratory by express. The samples are collected in large bottles for chemical analyses, and in small sterilized bottles for bacteriological examination. The bottles for the bacteria samples hold two ounces, and they are sterilized each time before use. The stoppers are covered with pieces of tinfoil, and each bottle is then placed in a screw-capped

tin box just large enough to receive it. The bacteria samples are shipped in portable ice boxes. There is an outer box with asbestos packing and a copper lining, and an inner copper tray divided into compartments to hold the tin boxes just mentioned, and between the outer boxes and the tray is a large space for ice. The boxes hold sufficient ice to last eight hours in hot weather.

The samples are almost invariably received in good condition. When the samples reach the laboratory, each is given a serial number and entered in an index book. The physical examination of water includes the temperature of the sample at the time of collection, the amount of sediment, and the turbidity after standing twelve hours, the color and the odor.

The sanitary chemical analysis ordinarily includes the determination of nitrogen as albuminoid ammonia, free ammonia, nitrites and nitrates; total residue on evaporation, loss on ignition, chlorine, iron and hardness. In addition to these the following determinations are sometimes made: Oxygen consumed, alkalinity, incrusting constituents, dissolved oxygen, carbonic acid, etc.

Microscopical examination of the water determines the number and kind of microscopic organisms present, together with the amount of amorphous matter. The bacteriological examination consists of the determination of the number of bacteria present in the sample of water and a qualitative test for the presence of bacillus coli communis.

The miscellaneous work in the laboratory includes the analysis of coal, lubricating oil, boiler scales, boiler compounds, cements, deposits from driven wells, etc. These are all problems of engineering chemistry, and the most important part of this work is the analysis of coal. Most of the experimental work that has been carried out in the laboratory has been in connection with problems pertaining to the condition of the water supply; but, in addition to this, considerable attention has been given to the study of methods of water analysis and to other subjects of scientific interest. Probably the most important work of this kind was the ascertaining of the normal chlorine for the watershed of the Brooklyn water supply, and the observations have been extended over the whole of Long Island. Samples were collected from seventy-seven sources and from the results of their examination, a map of normal chlorine for the island has been prepared. This map shows that except at the east end of the island, and except near the coast, the normal chlorine is below six parts per million. The results which have been obtained by the establishment of this laboratory would warrant other cities in opening similar laboratories.

"LAWN tennis elbow" is one of the modern complaints, and appears to be associated with a certain stroke used by expert players. It is sometimes caused by a sudden strain or long-continued overstrain.

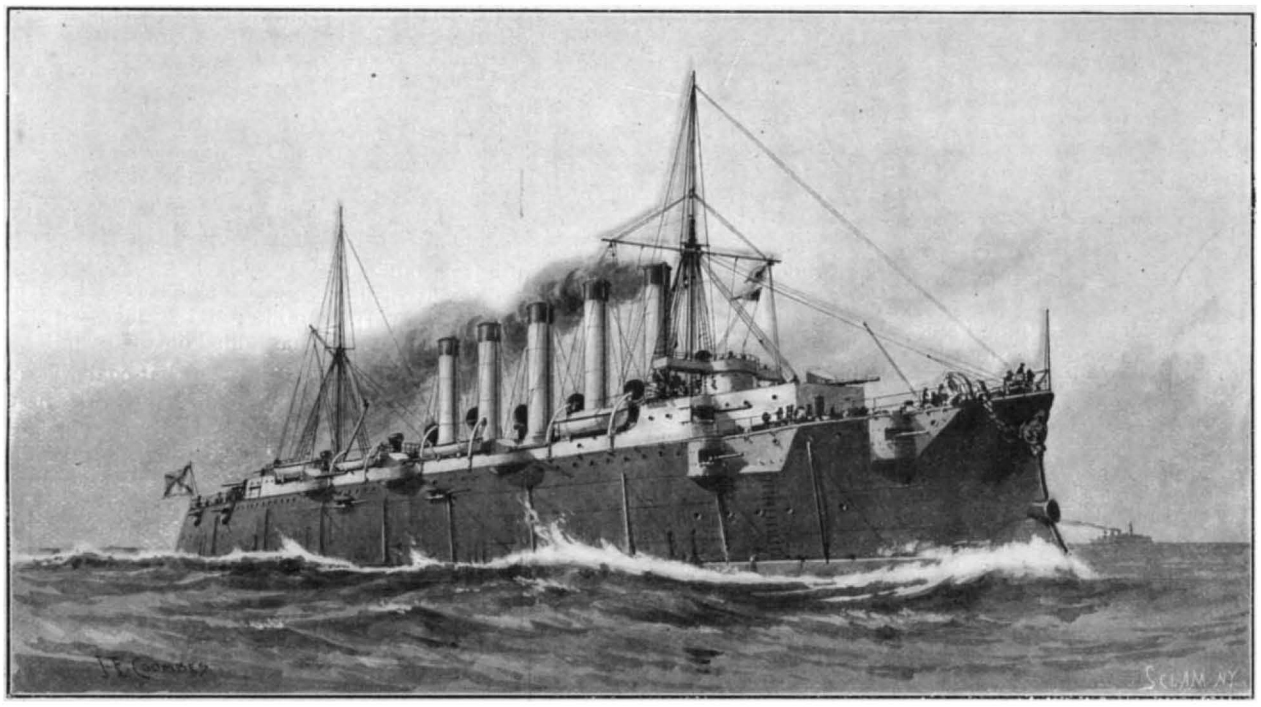
TWO NOTABLE HIGH-SPEED FOREIGN CRUISERS.

It is now many years since our famous high-speed cruisers, "Minneapolis" and "Columbia," startled the naval world by the then unprecedented speed which they achieved on their trial runs. The "Columbia," it will be remembered, maintained on her trial an average speed of 22·8 knots an hour, while the "Minneapolis" was officially credited with an average of 23·07 knots an hour. Nothing of the kind had hitherto been accomplished by vessels of the size and sea-going ability of these ships, and it is a fact that to accomplish these results considerable sacrifices were made in their offensive and defensive qualities. The armament was light, and the protection was confined to an armored deck. Contemporary vessels of the "Minneapolis" and "Columbia" that carried heavy armament and were protected with a belt at the water line, such, for instance, as the "New York" and "Brooklyn," only secured these advantages by a sacrifice of speed.

Improvements in the materials of construction, the introduction of tubular boilers, and the construction of engines suited to a high speed of revolution, have enabled designers to provide heavily armored vessels with a speed which was altogether impossible at the time the "Minneapolis" and "Brooklyn" were built, with the result that it is getting to be quite the fashion to provide even the armored cruisers with sufficient power to drive them at speeds of from 22 to 24 knots an hour.

We present illustrations of two of the latest of the high-speed cruisers that have been built in European yards. Both of them are required by contract to achieve a speed of 23 knots an hour. One of them, the "Chateaurenault," has had her trials, and has easily exceeded 23 knots an hour, the speed on certain stretches of the trial course reaching within a fraction of 25 knots per hour.

I. "Askold."—The "Askold" is one of the four protected cruisers which are being built for the Russian navy in foreign shipyards. One of these, the "Waryag," has been constructed at the Cramp shipyard, Philadelphia; and is now undergoing her trials. Two others, the "Bogatyr" and the "Boyarin," have been built respectively at Stettin and Copenhagen, while the "Askold" is nearing completion at the Germania yard, Kiel. All four vessels are to have a speed of 23 knots an hour, and carry the same armament, although there will be a difference in the matter of its disposition. The "Askold" has a displacement of 6,000 tons on a draught of 20 feet 4 inches. She is 426 feet 6 inches in length, 49 feet 3 inches in beam, her normal coal supply is 710 tons, while her bunker capacity is 1,000 tons.

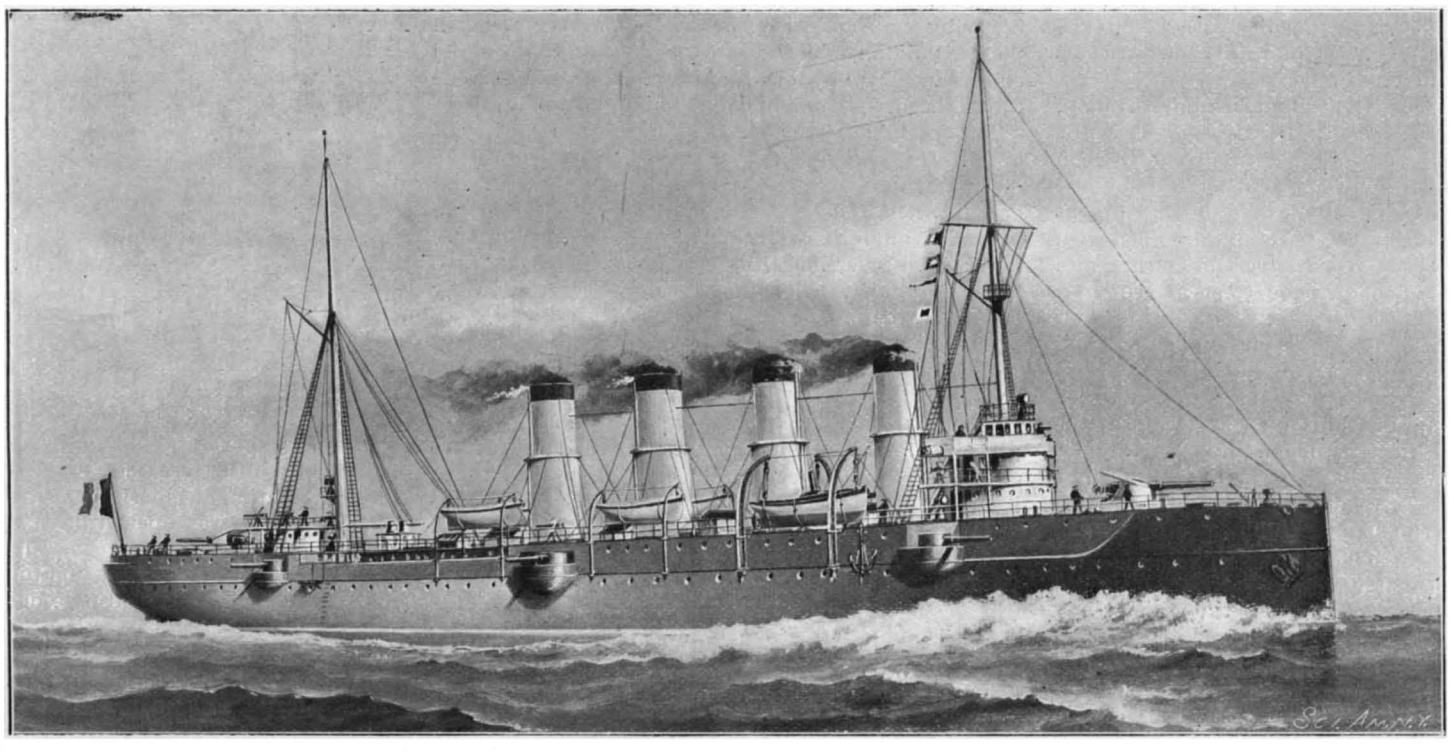


RUSSIAN, 23 KNOT, PROTECTED CRUISER, "ASKOLD."

Displacement, 6,000 tons. **Speed,** 23 knots. **Maximum Coal Supply,** 1,000 tons. **Armor:** Deck, 3 inches; gun positions, 3 inches and 5 inches. **Armament:** Twelve 6-inch rapid-fire; twelve 3-inch rapid-fire; eight 3-pounders; two 1-pounders; two machine guns. **Torpedo Tubes,** six. **Complement,** 500. **Date of Completion,** 1900.

It will be noticed that the ratio of beam to length in the "Askold" is about 1 to 9; a most exceptional proportion for a warship, and one that is only found in fast steamers of the merchant marine, and in small fighting craft of the torpedo boat and destroyer type. In this respect the "Askold" differs materially from the other three vessels of her class, the "Waryag," for instance, having a beam of 52 feet and a length of 420 feet, or about 1 to 8. In consequence of her finer lines the "Askold" is 500 tons less in displacement than her sister ships, the "Waryag" displacing 6,500 tons and the "Askold" 6,000 tons.

Her armament is identical with that of the "Waryag," although it is somewhat differently disposed. It consists of twelve 5·9-inch guns, of which six will be mounted in sponsons, three on each broadside on the main deck, while four will be mounted in recessed ports on the same deck, two forward and two aft. Of the other two guns, one will be mounted on the quarter-deck and one will be mounted on the superstructure deck, above the forecastle, and well toward the bow. All of the above guns will be of the rapid-fire type. The "Askold" will also carry a dozen 3-inch rapid-fire guns, four forward, four aft, and four amidships on the gun deck; eight 3-pounders, two 1-pounders and two automatic machine guns. She will also be provided with six torpedo tubes, two of which will be submerged. The protective deck will be 3 inches in thickness, and the principal gun positions will be protected by 5-inch to 3-inch nickel steel.



FRENCH, 23 KNOT, PROTECTED CRUISER, "CHATEAURENAULT."

Displacement, 8,018 tons. **Speed,** 23 knots. **Maximum Coal Supply,** 2,100 tons. **Armor:** Deck, 2¾ inches horizontal, 4 inches on slopes; gun positions, 2¾ inches. **Armament:** Two 6·5-inch rapid-fire guns; six 5·5-inch rapid-fire guns; ten 3-pounders and five 1-pounders. **Complement,** 625. **Date of Completion,** 1900.

It must be confessed that the "Askold" has a very striking appearance, and is suggestive of an overgrown torpedo boat destroyer more than of a first-class cruiser. This is due in part to her possession of no less than five tall smokestacks, a number which has never before been placed on a warship. Her boilers will be of the water-tube type, and will supply steam to three sets of triple-expansion engines, driving three propellers, a system which was adopted with success in

our own "Minneapolis" and "Columbia." The complement of the "Askold" is to be 580 officers and men. If our readers wish to make further comparison of this fine vessel with the sister ship recently built by the Cramps, they are referred to the SCIENTIFIC AMERICAN of November 5, 1898, in which will be found an illustrated description of the "Waryag."

II. "Chateaurenault.—The French protected cruiser, the "Chateaurenault," was laid down at La Seyne in 1896 and launched in 1898. She is 443 feet long between perpendiculars, has a beam of 55 feet 9 inches, and a mean draught of 22 feet 6 inches with a displacement of 8,018 tons. She is thus about 600 tons larger than the "Minneapolis." Like her, she is driven by three sets of vertical, triple-expansion engines. The boiler plant consists of fourteen Norman-Sigaudy double-ended boilers, which supply steam at a working pressure of 210 pounds to the square inch. It will be seen that she has unusual smokestack capacity, for not only are there four smokestacks, but they are of large diameter. Hence, the "Chateaurenault" should have no difficulty in realizing a natural draught horse power of 13,800. The contract horse power under forced draught is 23,000, and the corresponding speed is 23 knots.

The armament consists of two 6·5-inch rapid-fire guns mounted on the main deck, one forward, one aft, and protected by shields, each gun having a separate ammunition hoist; six 5·5-inch rapid-fire guns in sponsons on the gun deck, two firing dead-ahead and two dead-astern, and each protected by a circular shield; and ten 3-pounders and five 1-pounder rapid-fire guns mounted in commanding positions throughout the ship. For protection the vessel depends upon a steel deck which is 2¾ inches thick on the flat and 4 inches thick on the slopes above the machinery. There is also 2¾ inches of steel protection on the sponsons for the guns.

The "Chateaurenault" is designed for the same class of work as our "Minneapolis" and "Columbia," that of commerce destroying, and in order to prevent detection when she is searching for the merchant ships of the enemy, she has been made to conform, as far as possible, to the outward appearance of a modern trans-Atlantic steamer. Hence, there are no fighting tops on the vessel, and her masts and funnels are given the rake and trim appearance which characterizes the pole masts of a merchant steamer.

SOME PERSPECTIVES OF THE PARIS EXPOSITION.

Notwithstanding the amazing proportions of the Paris Exposition, the utmost perfection of detail has been maintained throughout. The casual visitor may look upon it as a mere agglomeration of beautiful, and, perhaps, fantastic buildings which have been erected for the entertainment of sightseers, but to the thoughtful it is something more than an ephemeral fairyland. It illustrates in the most elaborate manner possible the progress made by man during the last one hundred years in every department of art, science, and industry. It is a veritable epitome of the natural and industrial resources of the entire globe. The exhibition palaces are of vast size, and some of them are handsome, but others show that the too great facility with which staff can be worked, often results in rather meretricious decoration.

In the area between the Alma and Invalides Bridges, the nations have built a most bewildering series of palaces and pavilions and the effect produced by them is singular and pleasing. "Old Paris" adds a keynote of mediævalism and serves to link together the present and the past. The amusement sections are filled with interesting shows of a more or less serious nature, and the East adds a series of picturesque streets and squares. The Exposition authorities have endeavored to render the exhibition as complete as possible by inaugurating in each department retrospective and centennial sections in which the visitor can compare the past with the present and can form his own estimate of the wonderful advance since the time of Napoleon I.

There are forty-five entrances to the Exposition, but the visitor strolling down the Champs Elysées naturally comes first to the monumental entrance at the Place de la Concorde. This great gateway, designed by M. Binet, is, without question, the most criticised building that has ever been erected at this or any other exposition. It is familiarly known as the "Salamander," owing to its resemblance to a stove commonly so denominated. In its main lines it resembles somewhat a great wicker basket with long, curved handles, the whole affair being inverted and crowned by a female figure. It is painted blue, green and white, and the gilding is considerable. The front arch, facing the Place de la Concorde, is surmounted by M. Moreau-Vautier's startling creation. The figure is supposed to symbolize Paris, and is clad in the today's costume of a Parisienne. It terminates worthily the one conspicuous failure of the Exposition. The public enters through the great arch, and disperses by the two lateral arches, after passing through one of the seventy-six turnstiles. This arrangement is most ingenious, and permits of nearly one thousand people per minute entering the grounds at this point alone. The turnstiles are placed back to back in double rank.

The visitor, after entering the gate, finds himself in a vast pleasaunce extending from the Place de la Concorde to the Pont des Invalides, The space is admirably filled with thousands of plants and flowers. The visitor crosses the Avenue Nicholas II., which separates the two Palaces of Fine Arts and then passes down the Rue de Paris, along which are distributed the buildings of the city of Paris, the Horticultural buildings and the palace where the congresses are to be held. Directly across the Seine is the "Street of Nations," with the picturesque and interesting buildings. The Quai d'Orsay continues the "Streets of Nations," after passing the Pont de l'Alma, but the Pavilion of Mexico is the last of the national buildings. Then comes the Pavilions of Hygiene, the Navy and Military Pavilion, the Palace of Navigation, the Pavilion of Forestry, etc.

We now reach the Champ de Mars, the arrangement of which is much the same as it was in 1899, but the long buildings on either side are quite different in design from those of the earlier Exposition, and the masking of the façade of the Electricity Building by the enormous Château d'Eau is most successful. It is in the form of a gigantic grotto, in which at night a fountain of rainbow-colored water plays incessantly. In the center of the immense basin is a symbolical group representing Humanity and Progress. The Palace of Electricity lies directly behind this ornamental fountain, and in the rear of it are the sections of Agriculture and Food and the great Salle des Fêtes. The Palace of Agriculture was the old Machinery Hall, and it has been completely changed. The buildings on both sides of the Champ de Mars extend from the Electricity Building to the Eiffel Tower. On the right side, beginning at the Electricity Building, are the sections given up to mechanical industries, civil engineering, transportation, education, letters, science and arts. On the other side are the buildings devoted to mechanics, textiles, mines and metallurgy.

The Eiffel Tower forms a great entrance to the Champ de Mars and was, perhaps, one of the chief attractions of the Exposition of 1889, and is the loftiest tower in the world, being approximately 1,000 feet high. The tower weighs 16,000,000 pounds, and millions of rivets were used in its construction. It has been recently repainted, and 60,000 pints of paint were used for each coat. It is illuminated at night by 7,000 electric lights of ten-candle power each. The view of the Exposition from the top of the tower is most attractive, the bright colored pavilions, towers and terraces showing off to the greatest advantage, and producing an effect of confused architectural magnificence never to be forgotten, recalling in many ways one of the fantastical panoramas of Doré. At the base of the tower are various concessions and exhibits, such as the Tour de Monde, the Palace of Costumes, the Cinéorama, the Maréorama, the Grand Celestial Globe, and various panoramas.

Standing at the Eiffel Tower the view of the Trocadéro is most imposing. In 1878, the Palace du Trocadéro was considered a wonder, but it now looks dingy by contrast with the white and parti-colored plaster buildings in the gardens housing the colonial exhibits. There is enough of the East about the scene to produce a bizarre and delightful appearance.

The ensemble of the Exposition shows a variety of architecture which might be called "architecture de fête," and reminds one of the handsome façades and arches which Renaissance architects and painters were so fond of building on all gala days. The architecture is nowhere severe, color is freely used and sometimes becomes vulgar. The question may very reasonably be asked whether or not any part of the Paris Exposition is of as effective architecture as the "Court of Honor" at our own Fair of 1893. On the whole there is not, although certain parts of the Paris Exposition are very fine, the Seine particularly playing an important part, it being rather more picturesque than any feature of our own Fair. The natural beauty of the site has not been destroyed, the gardening is perfect and everywhere there is an evidence of taste and good judgment in decoration with the exceptions noted, and over the whole Exposition there reigns a holiday air.

AT the annual meeting of the American Academy of Medicine, Dr. Pyle referred to an article which appeared in a New York paper, entitled "Sleep Cure for Nervous Diseases." This cure consisted of eight grammes of bromine in a half glass of water every two hours. The paper also stated that the discoverer of this cure also maintains that rest—absolute prolonged rest—is the one thing which persons suffering from nervous disorders stand most in need of, and that they can obtain the rest through the agency of "bromine" better than any other way, says The Medical News. This only shows the great danger of medical advice which is given so freely in the daily papers. Bromine in an overdose acts as a corrosive poison and produces violent inflammation of the lips, mouth, tongue and œsophagus, with incessant burning pains followed in two hours and a half by prostration ending in death.

Engineering Notes.

In Siberia acetylene gas is largely used to light up various operations along the line where work is carried on at night.

The railway authorities of the Mexican government have been ordered to use certain safety appliances. All the passenger cars must be so equipped before the end of 1904.

Forty-one gas engines using blast furnace gas are working in Germany, the total horse power aggregating 21,950. The horse power of such engines in Belgium is 3,700, France 3,250, and England 2,060.

London is to have a new street, which will give a great thoroughfare north and south. The new street will begin at Theobald's Road, will cross High Holborn, and will finally reach the Strand by means of two arms which are limited by Somerset House.

The railway mileage of Europe has increased from 83,680 miles in 1875 to 167,439 miles in 1899. The increase has been the largest in Russia, amounting to no less than 15,142 miles; then comes Germany, 14,666 miles; and France with 12,990 miles; while England has added only 5,089 miles.

It is said that coal was mined prior to 1113. In the Liège district coal was first found about 1199. In 1214 coal was attracting some attention on the southern side of the Firth of Forth. This was a hundred years after the mines in the Worm district are said to have been opened and regularly worked. It is not likely that coal was mined in Great Britain before the thirteenth century.

The fire department of New York city has 94 engine and hook and ladder companies, and 1,375 officers and men in the Boroughs of Manhattan and Bronx, and the Boroughs of Brooklyn and Queens have 80 such companies and 1,029 officers and men. There are also 6 powerful fireboats in commission. The Boroughs of Richmond and Queens have a volunteer service of 1,725 and 2,000 men respectively.

A corporation has applied to Congress for permission to lay underground pipes in the streets of Washington, D. C., for the purpose of distributing cool air through the business buildings and residences of the city. The scheme provides for the erection of a refrigerating plant at some central point, from which cold air will be pumped for distribution through the system of pipes. The flow of cold air will be regulated in a manner somewhat similar to the measurement of gas, and can be turned on the same as hot air is turned on from a furnace.

The new engines of the Denver & Rio Grande Railway have iron pipes extending along the roof of the cab and connecting with the boiler. Through this pipe, without making a perceptible motion, says The Railway Review, either the engineer or fireman can send, under 200 pounds pressure, a jet of steam and boiling water that would effectually kill or injure anything living that happened to be on the tender or the front end of the baggage car. The blow-off cock thus arranged is expected to prevent train robbers climbing over the tender.

The West Shore Railroad Company recently had some litigation with a refrigeration company over a piece of land. The railroad company had a spur of track on the property, and when the refrigeration company began to drive piles for the foundation of its new building, the railroad company ran an empty box car upon the tracks and halted it in the line of the pile driver. The workmen proceeded to saw the car in two and throw off the piece that lapped over onto their property. The person, at whose instigation this was done was arrested, and a freight engine was backed upon the disputed property. The case was taken into court.

At the acetylene works which supply the gas to the Hungarian street railway, chloride of lime was formerly employed as the purifying material. They now use a mixture of chloride of lime and sodium plumbate containing an excess of alkali. Chloride of lime alone is likely to cause the explosion of the gas, on account of the liberation of chlorine. A purifier charged with a new mixture was opened after ten hours' working. When the upper grating, covered with lime, was removed, spontaneous combustion took place, and a long flame rose from the apparatus, but there was no explosion. Under these conditions, therefore, it is safe to say that the new mixture is not dangerous.

The administration of the Chinese Custom House has recently published its annual report, according to which the exterior commerce of China has been, in 1899, 460,000,000 of taels (the tael equals about 75 cents), this being an increase of 21,000,000 over 1898. The revenues of custom houses were 26,000,000, and increase of 3,000,000 over 1898. The exports have been 195,000,000, surpassing those of 1898 by 36,000,000, and the imports are valued at 264,000,000. The imports from America and Japan have given the greatest increase. The vessels which have entered in 1899 into the Chinese ports give a total of 5,479,000 tons, the figure for 1898 being 4,927,000. England represents 59 per cent of the total; China, 24; Japan, 7; Germany, 5; France, 2; America, Sweden and Russia, each 1.

Science Notes.

The Italian faster, Succi, has been declared insane and is confined in an asylum.

A solid train of twenty carloads of salt was recently shipped from Salt Lake City, Utah.

Prof. Loeb, of the University of Chicago, has made interesting experiments upon the artificial fertilization of the eggs of sea urchins, and the production of larvæ after an immersion of two hours in a solution of magnesium chloride and sea water. The sea water and the instruments were carefully sterilized.

The arrow poison of the Wagogo, is derived from the juice of the bark of two Euphorbiaceous trees by continued boiling. Briéger has isolated therefrom a crystalline body, which corresponds chemically and physiologically with the Wakamba arrow poison. The Euphorbia juice appears to act as a progressive poison.

The ninth volume of "Le Opere di Galileo Galilei" was recently published in Florence, and shows that he had an excellent appreciation for Italian literature. The six volumes include an address which he made on the topography and configuration of "Inferno." This was delivered before the Florentine Academy of Sciences.

A new developer has appeared, orthodioxybenzol, which, under the name of Elconal, is proposed by Dr. Ludwig Ellon. It has the singular property of allowing a mixture of hypo in all proportions, and a combined developing and fixing bath may be thus prepared. It is spoken of very highly by photographers who have used it.

Portugal was very liberal to scientific men at the time of the recent eclipse. The Custom House employes were ordered to give astronomers every facility for the entry of their baggage, their instruments being admitted free on the presentation of a certificate from an astronomical observatory countersigned by a Portuguese consular agent.

Rubber culture was first scientifically undertaken at the Botanical Gardens at Peradeniya, in 1876, by Dr. Trimen, and in 1897 Ceylon boasted of 250,000 trees of the Brazilian variety which yielded an amount of one pound and a half per tree, fifty trees being planted to the acre. It is fortunate for Brazil that very little of the East possesses the soil, climate and conditions necessary for such competition. The present tendency is now to introduce machinery and chemical processes in South America requiring more or less technical skill. Some companies are using centrifugal machines.

The walls of the Comédie Française, Paris, were found to have been severely damaged by the fire, and one of them needs practically to be rebuilt, while much has to be done in the way of strengthening the remaining three. The corridors and staircases are to be widened and the arrangement of the dressing-rooms is to be modified. The building will be lighted and heated on an entirely new system, and elevators will be provided both for the use of the public and the actors. The theater will probably be a model one, if the plans are carried out to a successful completion. It is not likely that the Comédie Française will be completed until the close of the present year.

The new developer, adurol, which is prepared in Germany, is increasing in popularity. According to the report of the Imperial College, of Vienna, it is superior to hydroquinone as a developing agent, and gives less fog. The image, developed in adurol, appears in five to ten seconds, as compared to forty seconds with hydroquinone; the development is completed in four to five minutes as against six to seven minutes with the latter. The finished image is also somewhat softer in tone. Prof. Vogel, the late eminent photographic authority of Berlin, and Prof. Bothamley, of London, are of the same opinion, and prefer the new developer to hydroquinone.

In Annam the number of persons who live mainly upon fish is estimated at five millions. The fishing industry has reached a considerable development in that country. The region most abounding in fish is that of the southern provinces, Binh-Thuan and Khanh-Hoa, and that of Thanh-Hoa in the north. The latter district supplies fish to the Tonkin markets and a part of China. The two former provinces, owing to the numerous bays where fishing may be carried on in all seasons, supply the salting establishments which furnish their products to Singapore and the extreme Orient. In other regions of the coast of Annam the supply of fish serves only to supply the needs of local consumption, and is even insufficient for this. As to river fishing, it is reduced to the needs of the inhabitants of the banks. The outfit of a fishing bark of small tonnage is four men and two children, and for the large sailing junks it consists of seven adults and three to four children. The number of persons engaged in the fishing and kindred industries in Annam has been estimated at 30,000, of which 6,000 are in Thanh-Hoa and 5,000 in Quang-Nam. In adding the women and children, this number may be carried to 60,000, representing the total number of natives who make their living from the fishing industry.

Electrical Notes.

The main lighthouse at Sandy Hook was struck by lightning on May 21, and its electrical apparatus was much injured; oil had to be used in the lamps.

Electricity is to take place of steam at the shifting tables of the 30-inch rolls at Homestead, Pa. The only part of the plant which will be operated by steam will be the big roll engines.

From April 15 to May 13, 799,479 passengers paid for using the moving sidewalk and the third-rail system in the Paris Exposition grounds. The greatest number of passengers carried in one day was 75,000, says The Electrical World.

Electric traction which the London Metropolitan District Railway have introduced upon their system between Earl's Court and High Street, Kensington, is giving satisfaction. The train consists of six coaches with a motor car at each end. The total length of the train is 245 feet, while its aggregate weight is 180 tons, and has accommodation for 312 passengers. The motor cars, with a rating of 800 horse power each, impart a mean speed to the train of 15 miles per hour, which is an increase of four miles upon the steam locomotive traction now in vogue. They can, if necessary travel at 20 miles per hour, and can attain that speed within 200 feet from starting and can be brought to a standstill in 130 feet which is only a little more than half its own length.

Mr. Richard Kerr, F.G.S., has been exhibiting to the members of the Royal Society in London his latest development of the Hertzian wave system. This is a clock, the movements of which are controlled from a distance by means of wireless telegraphy. The inventor proposes to be able simultaneously to adjust the whole of the clocks in London by means of this single timepiece. In order to render a clock sensitive to the waves he affixes to it a receiving instrument with a coherer. Then he establishes a transmitter at some point in the city, and by simply pressing a button every clock equipped with the receiver would be influenced, and the hands moved to any desired part of the dial. Not only would public clocks be synchronized in this manner, but the system might be extended to the timepieces in private residences as well.

The Postal department of the English government have commenced work upon the new telephone system with which London is to be supplied. Up to the present time the National Telephone Company have enjoyed a powerful monoply, but the system has proved so unsatisfactory, that in deference to public opinion the government have entered the field of competition. Many of the subways to carry the wires—the underground system is to be employed—have been designed and are ready for excavation. The area is officially designated "The London Telephone Area," and practically covers the same ground as that served by the private company. The government scheme when completed will cover an immense area of over 600 square miles, and it is expected that the major portion of the system will be in working order in about twelve months' time. The central exchange will be situated near the present Post Office Savings Bank, while subexchanges will be distributed throughout the area. Ladies will be engaged in the exchanges throughout the day, and men will attend to the same duties during the night.

Three large engines of 3,000 horse power have been furnished by Sulzer Brothers, of Winterthur, Switzerland, for one of the electric stations of Berlin; these are triple-expansion, with four cylinders. The two low-pressure cylinders, of 50 inches diameter, are placed side by side, with their axis 8 feet apart; their pistons each operate a crank upon the main shaft, these being placed 90° apart; and the two high-pressure cylinders are placed over each of these respectively, with common piston rods. The upper and lower cylinders of each pair are separated by a distance of 5 feet, so that the pistons of the latter may be taken out without difficulty. Three iron columns fixed to the lower cylinder support the upper; the stroke of all the pistons is about 4·2 feet. A strong foundation-plate supports the bearings of the main shaft, which has a diameter of 1·4 feet; the superposed cylinders are carried on one side by a detached supporting piece, and on the other by iron columns. The vertical air pumps are connected with the piston-rod of the low-pressure cylinders. The latter cylinders have steam-cushions, as the use of superheated steam is provided for. The distribution to all the cylinders is made by four-way valves, which are operated by horizontal shafts worked by a vertical shaft carrying the governor, the latter being connected with the main shaft of the engine by helicoidal gearing. The valves are placed in the bottom and top covers of the cylinders. The main shaft carries at each end a fly-wheel 19 feet in diameter; having also on one end the armature of the dynamo. The engines make normally 85 revolutions per minute, which corresponds to a piston-speed of 12 feet per second. The great height of these engines may be observed by the fact that the top of the upper cylinder is 35 feet above the axis of the main shaft.

Automobile News.

Two lines of automobile communication will be opened for traffic in the neighborhood of Corunna, Spain, during the present year.

The London publisher, Alfred Harmsworth, while touring in France, has counted in one day, on the Riviera, 177 motor carriages and 269 motor tricycles.

A private automobile stable will be built in New York city in the fall. In addition to the carriage house, there will be a room for charging the batteries and quarters for the men who will take care of the vehicles.

A close observer states that by actual count the number of automobiles in regular use in Paris represents two or three per cent of the traffic on week days, with a very much higher average on Sunday and holidays, probably reaching five per cent.

At Maritzburg, in Africa, traction engines have been pressed into service by the British military authorities for transport purposes, and on some occasions they have been used to haul wagon-loads of refugee children into the country to give them an outing.

The Innsbruck Motor Car Company intends to run motor omnibuses on the most frequented of the Alpine highways. The vehicles will contain seats for fourteen persons, and will be as comfortable as the usual mail coaches. They will first run on the route from Innsbruck to Partenkirchen and to Oberammergau.

The automobile which has been ordered by the Prince of Wales from the Daimler Company has been turned over to Messrs. Hooper, of St. James Street, who are now finishing the body of the vehicle; it is to be ready in the month of June. The general finish will be in the same style as that of the other carriages belonging to the Prince, and it will, no doubt, be one of the finest automobiles to be seen in England. The body is of the phaeton type, with several modifications. The Prince has already had a number of lessons in the art of automobile driving, and will no doubt take a prominent place among the amateurs of the sport.

James T. Allen, of the Patent Office, has compiled a "Digest of United States Automobile Patents, from 1789 to July 1, 1899, including all Patents Officially Classed as Traction Engines for the Same Period." They are chronologically arranged under general heads of spring, steam, gas, air, electricity, gearing, traction-engines and miscellaneous. All the drawings are exactly reproduced from the patents, together with the claims, and a complete list of references cited against patents while pending as applications, together with lists of patents in the class of portable engines, traction wheels, electric locomotives and electric railway battery systems. The volume is particularly valuable, owing to the fact that no drawings are omitted, every sheet being given.

One of the latest types of automobiles is the new Swiss vehicle made by the Mees Company, in the canton of Zurich. Its construction presents a great number of interesting points. The company uses in its large vehicles a gasoline motor of the type known in Europe as balancier. Its two pistons move in opposite directions in a common cylinder, placed horizontally, and the force of the explosion which takes place between them is transmitted by piston rods and levers to a shaft with double crank placed above the cylinder in the recipient of the motor. In consequence, the motor unites the advantage of simplicity possessed by the single-cylinder type to those of a two or four-cylinder motor, namely, quietness and ease of working. It avoids the shocks which occur with the single-cylinder type, as the cranks are placed at 180° apart. In the smaller vehicles, a two-cylinder motor is used, this being placed in front of the vehicle. To diminish as much as possible the consumption of water, the explosion chamber alone is cooled with water, while the portions of the cylinder on each side carry the usual radiation ribs. In the large vehicles, the motor is placed on the rear axle, and is covered by a case provided with a shutter, and inclosing the reservoir of gasoline, which acts at the same time as carbureter, and the water recipient. These two contain from 50 to 60 quarts, and for long trips an extra reservoir may be placed on or under the front truck. The water which is heated in the envelope of the motor cylinder is cooled by an exterior spiral tube with cooling ribs, and is brought back to the motor by a small rotary pump. The transmitting mechanism is of a novel type, and consists essentially of a gear-wheel mounted upon the main shaft, with which engages a pinion on each side, these engaging in turn with a toothed crown which surrounds the whole. The arrangement of the mechanism is such that when the motor runs empty, the pinions revolve around the inside of the crown, but when they are prevented from turning by stopping the disk upon which their axles are mounted, the force is transmitted to the central wheel. By this arrangement the motor is always in gear, and it is thrown on or off without shock. The speed-changing device provides for 7·4 and 74 miles per hour, and an extra device gives also 6 and 13 miles.

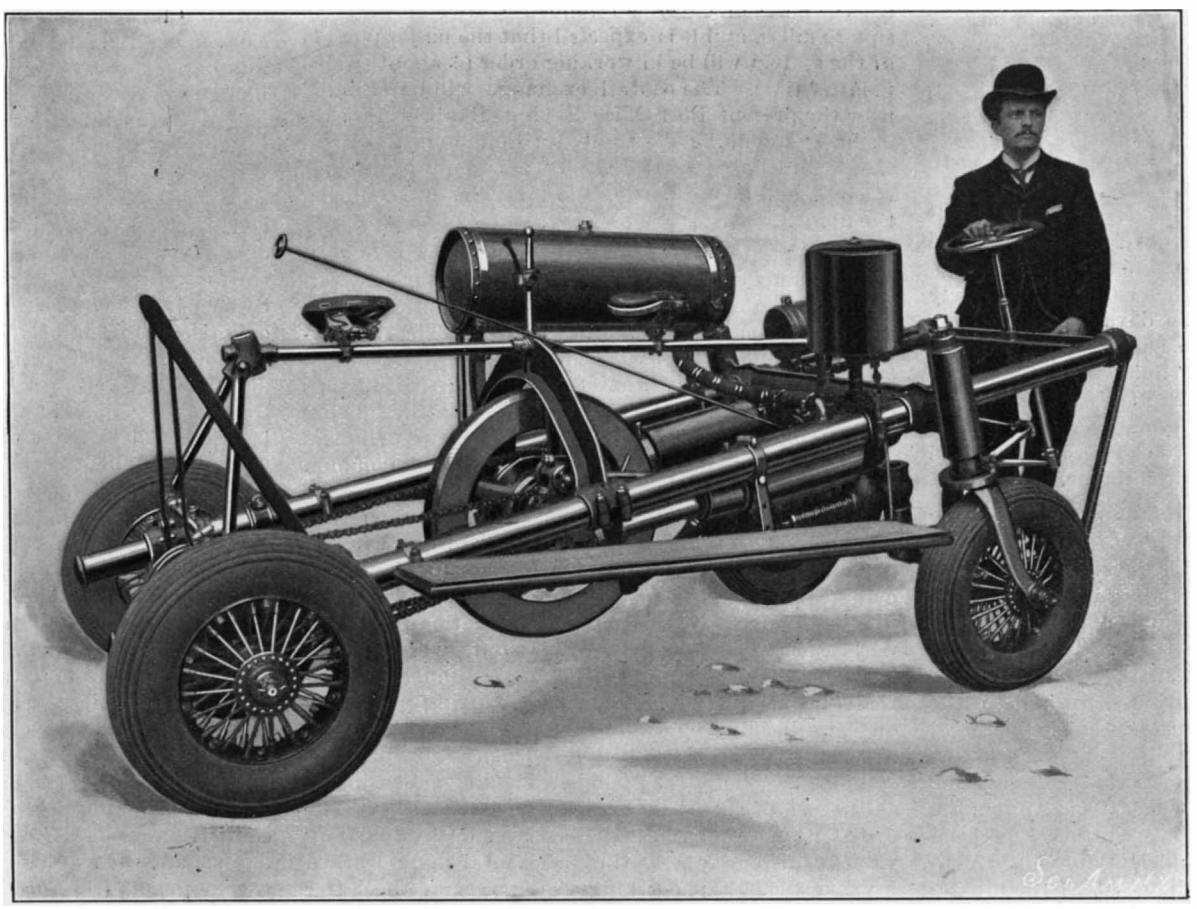
A MILITARY AUTOMOBILE.

The persistence with which the idea is advocated of utilizing the bicycle and the automobile in warfare, proves that the builders and users have full faith in the ability of these machines, not only to stand the tremendous strain of a military campaign, but to find a field in which they can give special and very suitable service. In a previous issue we illustrated the latest and probably the most successful attempt to utilize the steam traction engine in warfare. Generally speaking, such an armored train built for traveling across country, or on the roads, is an automobile, and as such it may be said to have proved that automobilism has a future before it in military operations.

The automobile herewith illustrated is a further attempt in this direction. The special field of operations for which the Pennington war automobile is designed is that of light artillery and the machine gun—more particularly the latter. It has been built with the idea of carrying a couple of Maxims or Colts with their detachment rapidly into action; and for this purpose it is provided with engines of exceptional power, and with a belt of armor not shown in the illustrations. It has been constructed with a low center of gravity, and its bulk has been reduced to the smallest limit consistent with the duties it is required to perform.

The framework of the machine consists of two longitudinal, 3-inch weldless steel tubes, to which the rear axle and the steering heads of the front wheels are firmly secured. The two main tubes and the whole framework are tied together with cross braces of manganese bronze, and with braces formed of a smaller diameter tubing. The crank shaft is placed in the middle of the frame at the point where the main cross brace occurs. A heavy flywheel is carried at the center of the shaft, and on each side of it and bolted to the main frames are two cylinders, 5¼ inches in diameter by 12 inches stroke, which are made of weldless tubing, and are water-jacketed. The cooling tank is carried on the front of the machine and serves the purpose of a wind-shield. Power is transmitted from the crank shaft to the driving shaft by means of two chains driven from either side of the flywheel. There are, as will be noticed from the engravings, gears for two speeds, the lower for hill climbing and for work on heavy roads, the other being a high-speed gear suitable to fast traveling on good roads. Changes in speed are effected by means of improved friction clutches which enable the gears to be thrown in and out without shock. The tank capacity, both for water and gasoline, is sufficient to enable these machines to run from 150 to 200 miles without replenishing. In order to secure thorough ignition, the motor is fitted with both electric and hot-tube methods of ignition. Leather covers are provided both above and below the running parts to protect them from mud and dust. It will be noticed from the engravings that the machine is well suited to the attainment of high speeds. Its center of gravity is very low, its bulk small, and its horse power unusually large, the latter being estimated at from 36 to 40 horse power. We are informed by the company that in a speed trial on a measured half mile of track, a rate of speed was attained of over a mile a minute.

It will be noticed in the engravings that the wheels because of the large diameter of the tires are well suited to rough roads. The wheels are 22 inches in diameter, the tires themselves are 5 inches in diameter. The total weight of the machine in working order is 1,500 pounds. As completed for war purposes, the machine will be covered on the front and sides with armor which will be proof against bullets, and except at close ranges, against fragments of shell. The machine will accommodate eight people; a steersman in front, a driver, who will occupy the rear seat, and a crew of six, seated three on a side above the footboards.



Cylinders, 5¼ inches diameter by 12 inches stroke; horse power, 36; wheels, 22 inches diameter; tires, 5 inches diameter; total weight, 1,500 pounds.

A MILITARY AUTOMOBILE.

Manila Women Lapidaries and Jewelers.

The lapidaries of our new Oriental possessions are the dark-skinned women of the Tagal tribe, who have acquired their skill and ingenuity in gem-setting from the artificers of Spain and Morocco. In delicacy of design and execution their work far surpasses that of their masters. Much has been written about the coral jewelry of Manila (pink coral necklaces, white coral pendants, and red coral rosaries like drops of blood), but the impression should not be gained that the lapidary art of the Manila women jewelers is confined to coral products. Pretty and characteristic as these objects of adornment are, they do not compare in value and beauty with the chains of woven gold, filigrees of silver, and pendants of pearls and garnets made by these women. Diamonds, amethysts, and similar stones are not so often met with in the native jewelry of Manila; but their rarity is not known, even though they are almost entirely lacking in the trinkets of the natives and foreigners in Manila.

Only native gems and minerals, such as garnets, black, yellow, and white pearls, coral, mother-of-pearl, and gold and silver, are utilized by the women jewelers. All of these island gems are found in the small shops of the native jewelers, and the manner in which they are worked up into ornaments of striking beauty and value attracts the attention of an American. A recent importation of many of these most popular Manila ornaments gives promise of their wide introduction into the United States. The specimens brought to this country, all the work of women artificers, show that the native lapidaries combine the ability of the Moorish gem worker with the patience of the Chinese and Japanese craftsman. Among these specimens are beautiful and exquisite earrings, necklaces, bracelets, chains, buttons, pins and brooches of every conceivable design. The chains are made of the most delicate strands of almost pure native gold, braided and woven like a piece of Manila hemp rope, with even the tiny threads imitated to perfection. So delicate and dainty is such a chain that one can hardly believe it possible that the women lapidaries beat out the rough gold and draw the gold wire without any of the modern implements used by Western gold beaters.

Hatpins of pure gold are made in the form of miniature Malay creeses with water lily leaves for handles. Breastpins and stickpins are often thickly studded with stones. Silver and gold filigree work, lacelike in appearance, is made with rare skill; other products of the women jewelers are necklaces and pendants of dainty gold ferns, flexible and yet strong, with every stem and vine veined exactly as in the original plant. Knives, brooches, and pocketbooks are cut out of mother-of-pearl, and thickly studded with green and red garnets. Black and white pearls are set in gold buttons and earrings. Like most of the Oriental craftsmen, the Manila lapidaries are expert in enameling, an art which they combine with their other work with excellent taste. The necklace may be of gold, enameled blue, and set with gray pearls, or of black enamel studded with red and green garnets. Few of these jewels are imitations. Nearly every woman lapidary strives to give an individuality to her work, and her products are proof of her success. The treasures of one shop can rarely be duplicated in those of another. Sometimes the conception may be a little crude and lacking in taste; but where there is one such example there will be a dozen that are perfect in every particular. The harmonizing of colors and combining of stones and metals show an instinctive taste among these illiterate Manila lapidaries which is difficult to explain. From the standpoint of the American jeweler there is much in the way of originality and perfection of design and execution that can be learned from these women of the Orient. In all the art they display something of the dark, sinister Moorish is always suggested, something that is felt in the abundance of Malay creeses, green and golden alligators, dragons, and knives of every design and color. G. E. W.

OWING to the high price of ebony the manufacturers of pianoforte keyboards have been searching for a long time for a cheap substitute with a grain close enough to take the necessary polish. At last it was found that our native dogwood could be stained, oiled and polished until it equaled ebony both in appearance and utility. The wood, which comes in all sizes, is sawed into strips an inch square and 8 to 20 inches long. The strips are piled up cobhouse style, out of doors, where they remain until thoroughly seasoned. The development of this industry has given employment to a considerable number of people, and has also permitted of the cutting of trees which were formerly considered to be of little or no value.

AT the 500th anniversary of the University of Cracow, an honorary degree was bestowed on Professor Simon Newcomb.

OSTIA, THE PORT OF ANCIENT ROME.

The subject of the trade of Rome is an interesting and important one. The metropolis of the ancient world at one time numbered about 1,000,000 inhabitants, and it was no small task to provision this city. Ostia, on the coast of the Mediterranean Sea, now about twenty-one miles by rail from Rome, was naturally the great entrepôt. It was settled in the second century after the foundation of Rome, by Ancus Martius, and soon became an important commercial town. Under Augustus it lost some of its importance, due to the choking up of the harbor by the Tiber. Christianity was introduced at an early date, and the Bishopric of Ostia, according to some accounts, was founded by the Apostles themselves. The early Popes were all consecrated by the Bishop of Ostia.

The Tiber at present washes down eight and one-half million tons of sand annually, and this gradual extension of the delta has left Ostia miles inland. The astronomer, Padre Secchi, and Prof. Lanciani have determined that the average yearly increase of the coast is about 19 feet.

The Tiber was a bad river to navigate, and while a man-of-war could easily get over the bar, owing to its light draught and great propelling power, merchantmen usually had to anchor outside and discharge their cargoes with the aid of lighters. The old Romans made no attempt to improve the harbor, which they could have done very easily, for vessels of 150 tons burden now reach Rome. In early times the vessels were towed up stream by oxen and buffaloes, tow-paths being provided for them. Navigation was not allowed at night, and the vessels had to moor at stations. Prof. Lanciani states that there were thirty of these stations between Rome and the sea. Vessels from Ostia often reached Alexandria in eleven days and Gibraltar in five days.

At Ostia the warehouses covered one-half of the town, which was two miles long and one mile wide. The city of Ostia must have presented a splendid appearance, as it contained fine temples, theaters, and villas of patricians, and the ruins were so extensive that for five centuries the villagers burned marble for lime without exhausting the supply; and when Poggio Bracciolini visited Ostia with Cosimo de' Medici they found the villagers occupied with burning an entire temple into lime. It is sad to contemplate the loss of so many antiquities, for the rude peasants burned wall facings and statues alike.

Our engraving represents the warehouses along the so-called "Street of Wharfs." The floors are raised three feet above the pavement to facilitate the loading of carts. On the opposite side the ruins seem to belong to the private houses of merchants, the ground floors and basements being used for storage purposes. One of the rooms is in excellent preservation. It is 36 feet long by 28 feet wide, with six rows of large earthern oil jars 4 feet in diameter, each marked with its capacity. Another store belonging to the same house is vaulted over and has two circular openings for light. The barrack of the firemen (*vigiles*) and constables is one of the important ruins of Ostia. These men were numerous, as frays and fires are very apt to occur where large bodies of lawless sailors are congregated.

ENTRANCE TO WAREHOUSES IN OSTIA.

Our first engraving shows a portion of one of the warehouses, and it may also be seen in the middle of the second engraving. It gives an admirable idea of the solidity with which the Romans built all constructions of this kind. Through the arch to the left may be seen the concrete which was faced with what is known as "*opus recticulatum*," where the stones were carefully cut so as to present a square or lozenge-shaped end, and are fitted very closely, one to the other. These little blocks are about 3 inches square and are arranged to run in diagonal lines; the angles of the wall have neatly worked quoins with the inner end pointed so as to work in with the small lozenges. The effect of this sort of facing is very neat, but its beauty seems to have been very largely concealed by stucco. The front walls of the warehouse were built of brick which average 1 foot 11 inches square. The voussoirs are also of brick and the pediment and entablature are admirably handled. The engraving is interesting as showing Roman methods of construction, and also as showing how well the Romans built, even where the structures were used for such ordinary purposes as warehouses.

OSTIA, THE SEAPORT OF ROME—THE PRINCIPAL STREET AND WAREHOUSES.

At the beginning of the empire, Rome had a population of a million, and the necessity of building a better harbor than that of Ostia, which was rapidly filling up, became evident. Claudius built a new harbor two miles up the coast of Ostia. It was inclosed by jetties; the area of the harbor was about 6,200,000 square feet, and the quays were

over a mile long. The breakwater was constructed with the aid of caissons. The huge ship by which the Vatican obelisk was brought from Egypt was filled with concrete until it sank, then it was strengthened with rocks until it was above the level of the sea, when it was crowned by a lighthouse. The Emperor Trajan, in A. D. 103, founded Porto, as the harbor constructed by Claudius as a substitute for that of Ostia had soon shared the same fate. Trajan constructed a new canal, which now forms the main arm of the Tiber. Trajan's port is now two miles inland, and is a shallow lake surrounded by ruins. It resembled in every way a modern port; it was hexagonal in shape, and the basin communicated with the Port of Claudius. Trajan's harbor is one of the most interesting works of Imperial Rome.

Egypt alone shipped 190,000,000 bushels of grain to Rome, and Sicily, Sardinia, and other places poured in their enormous supplies of foodstuffs. In addition to this may be reckoned the vast quantities of building materials, especially marble, which were imported. The Claudian harbor was also used as a great naval station, and here was also the central post office for foreign correspondence. In modern times harbors have been constructed on even a larger scale than the three harbors mentioned, which successively served to receive the great ocean-borne commerce of Rome, but none of them ever possessed the same magnificence.

IN addition to the discovery of the mummy of King Menepthah, the "Pharaoh of the Exodus," there have been other remarkable discoveries. The season was a productive one as regards exploration in Egypt. M. Legrani, while setting up the fallen columns of the temple, came upon a city gate, the first that has been found in Egypt; it is of great height and is made of large blocks of squared limestone and is double, having one gate within another. Two chariots could easily pass through it abreast. It was built by Amenhotep II. of the eighteenth dynasty. The Exploration Fund has been restoring the temple of Der-el-Bahari at Thebes, and one day while Mr. Carter, the inspector of antiquities in Upper Egypt, was riding up to the door of the house occupied by the excavators, he noticed that his horse's hoofs sank in a hole in the ground. Further investigation brought to light under the house the entrance to a large tomb of the eleventh dynasty in a perfect state of preservation.

Correspondence.

"The Armor-Plate Fiasco."

To the Editor of the SCIENTIFIC AMERICAN:

Your article on page 370 on "The Armor-Plate Fiasco" is true in every word; not only that, but because of the foolish acts of Congress, the government has laid itself liable for more than half a million of dollars damages to the contractors for detention of their work and delay in delivering their ships.

The Cramp firm already have a large claim against the government for just such detention on account of non-delivery of armor, and they will collect it too, not at this Congress or the next probably; but it will be collected. *Vide* the large collections made by the contractors of the Civil War, and the claims for damages for all the present contractors are much more meritorious than any of those of the Civil War.

And from the expenses of navy yard work, no one believes that the government can manufacture armor for less than $1,000 per ton.

Then, again, how about the up-keep of the establishment when we do not need armor?

JOHN R. THOMAS.

Washington, D. C., June 15, 1900.

Removing Foreign Substances from the Eye.

To the Editor of the SCIENTIFIC AMERICAN:

A simple way of removing cinders or any foreign substance from the eye, is to gently hold the eye open with the fingers and thumb of one hand, while with the other hand to dash light handfuls of water in and across it, so as to produce a current of water flowing over all the surface of the eye, and the under side of the lids. The effect of this almost invariably is to push the intruding object from the eye.

This simple method should not be mistaken for washing the eye or immersing the face in water and opening and shutting the lids. Any misdirected help often tends to imbed an object so that the removal is difficult.

The eye should not be rubbed or one lid drawn over the other, or a silk handkerchief drawn across the affected part, but the eye should be kept from winking as much as possible while prompt action is being taken to cause a current of water to pass over the surface of the ball.

This method is a copy from nature, for when very fine dust enters the eye, nature seeks to relieve it by means of the fluids which moisten and lubricate the eye; and when larger objects enter, and cling more tenaciously, the irritation causes a copious discharge of tears so that the eye overflows, as nature tries by flushing it to propel along and float away with the current the cause of the irritation. M. T.

Springfield, Mass., June 16, 1900.

[Our correspondent's advice, while excellent, will not, we think, answer in all cases. In turning metal on a lathe, chips are very apt to fly into the eye with considerable force, producing painful, if not serious, wounds. To add to the difficulty the chips are often hot. Water would hardly tend to dislodge foreign particles of this kind. It is also essential to have clean water for flooding the delicate tissues of the eye. Chips of metal in the eye are of such a serious nature that many eye hospitals have most powerful magnets for use in removing the chips.—ED.]

The Current Supplement.

The current SUPPLEMENT, No. 1278, has many articles of unusual interest. "The Mount Prospect Laboratory" describes the chemical and biological laboratories for the examination of Brooklyn (New York) drinking water. The various forms of apparatus for collecting samples are illustrated, as well as the portable ice chest for transporting the bacteria samples. "The Duddell Oscillograph" describes a most ingenious electrical testing instrument. "Liquid Air as a Means for the Manufacture of Oxygen" is by Prof. Henry Morton. "The Palaces of Fine Arts of the Exposition of 1900" is accompanied by two large engravings. "Hot Water Heating from a Central Station" is by H. T. Yaryan.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

RIDING-CULTIVATOR.—DANIEL V. FORSBERG, Laurel, Neb. Each shovel-beam of this riding-cultivator can be quickly and conveniently adjusted by the hands of the rider, either to be raised or to be shifted sidewise. The shovel-beams can be vertically adjusted at their forward ends and held in adjusted position, enabling the beams to be set so that the shovels will enter the ground to a greater or less degree.

MECHANISM FOR OPERATING CUTTING APPARATUS OF MOWING-MACHINES.—JOHAN A. DAUGAARD, 1 Helgolandsgade, Copenhagen, Denmark. Contrary to the usual custom, no cog-wheels are used for transmitting the motive power from the axle of the machine to the connecting-rod actuating the knives of the cutting apparatus. A driven wheel has an undulated periphery engaged by two of the arms of a three-armed lever, the third arm being provided with a socket in its end, by which a pin carried by a lug is received. A crank-lever has one member connected with the lug, the other member being connected with a pitman operating the cutter-bar. By regulating the length of the arms, the necessary movement of the knife can be obtained, even with very flat waves upon the rim of the driven wheel.

WEEDER.—LOUIS J. KLINGER, Dufur, Ore. This weeder comprises a short main frame attached to an axle. A draft-tongue is extended in front and rear of and beneath the frame, and is flexibly connected therewith. A cross-beam is rigidly attached to the rear end of the draft-beam and is provided with plows or scraping devices. The construction relieves as much as possible the strain put upon the draft animals and enables the weed-cutters to be readily raised or lowered.

Electrical Apparatus.

ELECTRIC-BATTERY ATTACHMENT.—HENRY B. WARE and CHAUNCEY C. CORNELL, Wymore, Neb. This invention provides an insulated tray to be placed between the elements of a gravity-battery to catch any particles that may fall from the upper or zinc element, thus preventing waste and the oxidation of the copper element, and maintaining an equal internal resistance of the battery and a uniform electromotive force.

TROLLEY.—JOHN H. WALKER, Lexington, Ky. The inventor has devised a simply-constructed trolley-harp and efficient means for catching and directing a trolley-wire into the groove of a trolley-wheel. Protracted cold weather will be but a slight impediment to the practical working of the device, for the exposed surfaces and bearings are so arranged as to afford ice but little opportunity to accumulate in the joints. The trolley-harp and catch device not only prevent a large percentage of the wear and tear of the wire and wheel, but also obviate the occasional expense caused by the pulling down of the wires and breakage of suspension-poles.

ELECTRIC RAILWAY.—AUGOST CASAZZA, Hoboken, N. J. The invention relates to a class of electric railways in which the cars or trains take their supply of electricity from a sectional power-conductor, the sections of which are successively connected with the live wire as the car or train passes over them. In Mr. Casazza's arrangement, a second sectional conductor is employed together with switches, each of which is connected in series with two adjacent sections of the second or switch conductor and controls the connection of the power-conductor sections with the feeder. In applying this system to overhead conductors, the inventor employs a special construction of supporting plates for the sectional conductors.

Engineering Improvements.

VALVE-GEAR FOR GAS-ENGINES.—CHARLES WERNER, Pine Grove, Penn. A spring-closed air-admission valve is employed, to which an arm is secured, provided with a catch. The catch is engaged by a hook carried on a rod reciprocated from the engine. Devices are controlled by the exhaust-valve-operating mechanism, whereby the engagement of the reciprocating rod with the air-admission valve is controlled and made to follow the opening of the exhaust.

Mechanical Devices.

FLOUR-BOLTER.—FREDERICK W. BROWN, Lee Bell, W. Va. The inventor arranges the bolting-chambers in triangular form, suspends them from the angles of the triangle, and locates the operating mechanism in the space formed by the chambers. Thus a compact bolter of great capacity is produced, which can be easily balanced to secure a uniform, gyratory motion without any backlash. Provision is made for supporting three bolting-chambers from three links and equally distributing the weight on the links. A portion of one chamber is made to serve as a housing for the cut-off of the adjacent chamber, when the cut-off is withdrawn from over its bolting-cloth.

FAN ATTACHMENT FOR ROCKING-CHAIRS.—FRANCIS C. and GEORGE E. MERTZ, Port Chester, N. Y. The object of the invention is to produce a device which is attachable to any rocking-chair and which is adapted uniformly to rotate a set of fans mounted to turn upon the chair. The result is secured by the insertion of a spring between the operating mechanism and the fan, the spring being wound up by the rocker and running down as the fan-carrying shaft is turned.

FUEL-PRESS.—GEORGE W. MURPHY, Northfield, Minn. This press is designed to press straw into compact form for use as fuel. The apparatus has a spirally-threaded conical compression-chamber at the large or receiving end of which a plunger is mounted to reciprocate, serving to force the material to be compressed longitudinally into and through the compression-chamber. The thread of the compression-chamber serves to turn the material to be compressed, causing it to be rolled into compact form.

SPEED-GEARING.—ABRAHAM A. A. LEVIN, Manhattan, New York city. By means of this simple gearing the speed of an operated machine or device can be gradually increased over the speed of the driving-engine, thus saving steam. A series of independent main crank-shafts are employed, on each of which a gear-wheel is mounted. Supplemental and independent crank-shafts are also employed. Connecting-rods join the cranks of opposite crank-shafts. Pinions on the auxiliary crank-shafts engage with the gear-wheels on the first-named crank-shafts. On a power-shaft, gear-wheels are longitudinally movable to engage the pinions. By this device three separate machines can be operated.

WIRE-TIGHTENER.—JAMES P. HADDIX, Mena, Neb. The wire-tightener comprises a frame having a notched segment and feet for engaging a fence-post. An angular lever is fulcrumed on the frame and has forked members. Notched bars are pivoted to the forked members of the lever and are adapted to extend on opposite sides of a fence-post. A pawl is carried by the lever and engages the notched segment in tightening the wire.

CAN-FILLING MACHINE.—DAVID F. BALDAUF, Eden, N. Y. On a frame, shafts, geared together, are mounted. Cams are extended on the shafts in opposite directions and are designed to move frames at the ends of the machine. A tray holds the cans to be filled; and a hopper feeds the material. The beans or other material are placed in the hopper. When motion is imparted to the shafts, the tray and hopper are rocked up and down alternately at opposite ends. This movement will cause the material in the hopper to spread out evenly and pass into the cans.

COMBINED LATCH AND LOCK.—LEWIS C. WETZEL, Bellefonte, Penn. This invention provides a novel gravity-operated lock, so constructed that the sliding latch-bolt serves as a locking-bolt which can be operated only from the outer side of the door by a suitable key. The lock can be cheaply constructed and is efficient in operation.

MACHINE FOR UNDERMINING COAL.—ANDI OCHTINSKY, Rockvale, Colo. This invention relates to mining machines and provides a portable machine adapted to be operated by hand and capable of easy shift laterally and in an advanced direction as the picks undermine the coal. The invention consists in special forms of devices for feeding the machine forward and for turning it laterally, and in other details of construction and arrangement of the parts.

TURBINE WATER-WHEEL.—JOHN W. TAYLOR, York, Penn. The object of the invention is to improve the construction of that class of turbines which receive the water upon the upper part of the buckets through stationary chutes surrounding the wheel, the admission of water being controlled by means of an annular or cylindrical gate, adjustable to open or close the water-inlets or chutes. The inventor provides a gate which is adapted to open downward and close upward, so that water is admitted at the top of the wheel, to produce the greatest effect practicable before being discharged from the wheel.

Miscellaneous Inventions.

WATER-COCK.—JAMES P. BENTON, 167 Second St., Dalles, Ore. The invention relates to water-cocks and faucets, intended for out-door purposes. The construction of this mechanism permits of the automatic bleeding or venting of the water of a stand-pipe. This is readily and completely effected without siphoning the water in the hose back through the stand-pipe. It causes the bleeder to be put into action by the stand-pipe instead of by keys, thereby venting the pipe every time the water is shut off.

THILL OR POLE COUPLING.—ALBERT H. FORSYTHE, Sarcoxie, Mo. Mr. Forsythe, in this invention, improves upon a former coupling. He combines the several parts so that they can be conveniently applied to any axle, and so that the shaft can be coupled to or uncoupled from a vehicle with less trouble and greater rapidity than heretofore. All rattling is completely prevented. The coupling comprises a clip, having cheeks which receive the knuckle of the pole. The clip has an attachment consisting of side pieces. A pin is secured to one of the pieces, the opposing piece being arranged for locking with and disconnecting from the pin. In pivotal contact with a locking and an opposing side piece, is a connecting bar. This bar carries a spring, the free end of which extends transversely below the pin.

PORTABLE BUILDING.—JOHN C. KARR, 1020 East Ravenswood Park, Chicago, Ill. By this method a light, portable building can be constructed so as to be quickly set up and taken down. The foundation comprises a plurality of sections with mitered ends where they meet at the corners and square abutting ends where they meet along the sides or ends of the building. Cast plates bolted to the wooden foundation have semicircular upward projections at the section joints, and other plates have circular projections secured to the foundation with bolts, which have hooks at the end to catch brace wires. An angle iron on each section receives siding, so that when the pipe-posts are set in the projections, the pieces are fastened together. This supports the siding, posts and roof on the foundation.

ACETYLENE GAS GENERATOR.—WILLIAM BURROWS MINOR, Deposit, N. Y. The operation of the apparatus is automatic. Arranged to prevent waste of carbid, the apparatus permits a ready recharging without danger of the escape of gas into a room, or without interruption of its generation. A supply-pipe and a series of generators are arranged to receive water; valves are adapted to govern the supply. Floats in the generators open and close the valves. A locking device at all the generators except the last, automatically holds the respective valves in position, and a connection between the locking devices and the float of the last generator allows the former to release the valves when the float is raised.

VENTILATOR.—CONRAD J. VOLLMER, Lafayette, Ind. The ventilator or grate in this device has a frame. Slats terminating at their upper ends below the top of the frame form a space between the frame top and the upper ends of the slats. The grate has a cover provided with slats for covering the spaces between the slats of the grate. It is free to move transversely through the space formed between the frame top and the upper ends of the grate slats. Lugs on the cover abut against the frame top to hold the cover in a nearly horizontal position. The ventilator is for use on buildings, and permits the passage of air to or from the part to be ventilated; or, allows its exclusion in winter time or during rainy weather.

HYDROCARBON-GENERATOR.—FRANCIS M. BAKER, Lomira, Wis. The device embodies novel means for regulating the generation of the vapor, by transmitting to the retort the necessary heat. The transmission is through separate conducting parts which are in contact to transmit the heat, and which upon being moved out of contact cease to pass the heat. In this way the generation of vapor is stopped. A wick feeds the oil or alcohol to the retort by capillary attraction instead of by gravity air-pressure.

ARITHMETICAL SLATE.—HARRY CLAUD SEILER, Milton, Penn. A slate-frame, a slate therein having

sight-openings spaced apart from it, and disks arranged between the bearing-bars and the slate, and made to expose portions of their surfaces through the sight-openings in the slate, together with pulleys and gearings for operating the disks—these comprise an apparatus for use in teaching and drilling in primary arithmetic, whereby problems in addition, multiplication, subtraction, and division can be quickly and accurately indicated.

CUFF-HOLDER.—LOGAN CUMMINS, Memphis, Tenn. The arrangement of this mechanism furnishes a convenient attachment to a coat-sleeve at any needed point of its length for bringing the cuff into the desired position relatively to the sleeve. The construction permits an easy attachment or detachment of the holder from the cuff. A spring-clasp engages the inner edge of the cuff, a spring attaching device having prongs to engage with a sleeve, and a link for connecting the spring attaching device with the clasp.

TAILOR'S SQUARE.—DOMENICO SEBASTIANO, Manhattan, New York city. This square has two blades. One is used for getting the position of lines extending across a pattern and which locates certain positions upon the garment, such as the bottom of the arm-opening and the waist-line. The other is laid out with groups of marks arranged in plural series, the groups of each locating points upon the cross lines on the other blade of the square. The marks of each group are so disposed with reference to the corner-angle of the square as to place corresponding patterns of different sizes.

SUSPENSORY BANDAGE.—ALFRED CHARLES MOSS, Streator, Ill. The harness supporting this bandage is suspended from the shoulders instead of from the customary waist-line. It can be worn without discomfort or irritation. Metal buckles or fastening devices are not required; so that the fastenings employed are flexible, readily adapting themselves to the body and permitting an effective adjustment to the person. There are two loops connected at the back by straps, one of the loops being provided at its lower end with an extending tape, and the other with a series of longitudinally-arranged loops with which the free end of the strap or tape can be interlaced.

MANDOLIN-CITHERN.—FREDERICK MENZENHAUER, Jersey City, N. J. In this instrument the strings are sounded by means of picks, so that a tremolo or mandolin effect is produced. The picks are actuated by keys depressed by the fingers of one hand, while the other hand or a separate motor yields the power necessary to vibrate the entire pick-carrier, the speed of which will be such that the strings will be sounded two or three times before the key is released, so that a sustained tremolo impression is produced. By turning the handles at varying speeds, a changing degree of tremolo is obtained. The cithern has a keyboard extending across the strings.

TOY MAN-OF-WAR.—MORTON E. CONVERSE, Winchendon, Mass. The construction makes this toy virtually an ironclad, the hull and turrets or mountings for the primary battery being of metal. The sponsons, ports, and guns of the secondary battery are offset from the hull by embossing their parts, the guns of the primary battery being detachably mounted in the upper or deck structure. There is a wheeled support for the toy. The hull is hollow and open at the bottom, whereby all the parts can be stored away in the hull, together with the wheels. This enables the toy to be easily packed in a small compass and shipped without danger.

LIQUID-AIR CONTAINER.—JOHN SPRATT WRIGHTNOUR, Oil City, Penn. This device is for the economical utilization of liquid air in hospital wards, residences, auditoriums, etc. It consists of an open cup for liquid air, situated in the middle of the floor of a chamber or reservoir made of thin heat-conducting materials to contain the gases evaporating therefrom. The reservoir filled with these evaporated gases, with its frost-covered surface, will make an excellent cooler for the room. There are outlet-pipes controlled by cocks for the issue of the evaporated gases. By proper manipulation, some of the oxygenated liquid air in the cup is permitted to flow out on the floor and wall of the reservoir to evaporate, highly oxygenated air being thus obtained. The liquid air left in the cup is retained for later use as desired, evaporation therefrom being retarded by insulation by the cold air above it.

CUT-OFF VALVE FOR HYDRAULIC ELEVATORS.—PHILIP F. CANTLION, Manhattan, New York city. The inventor has devised a valve for automatically cutting off the water-supply to the pressure-cylinder, should the elevator move too far upward, and to retard an outflow of water should the elevator move too far downward, thus preventing accidents should the ordinary valve mechanism become inoperative.

PIPE-FASTENING.—JOHN M. SPEAR and WINNIE R. STRAW, Plainfield, Wis. By means of this device, the diameters of pipes, thimbles, or elbows can be adjusted so that they can be readily made to fit the parts with which they are to be used. The pipe is split longitudinally and has a part of one edge formed with a lap turned outward and laterally and extending a part of the length of the pipe. The pipe has at its other longitudinal edge a lap extended inwardly and latterly throughout the length of the pipe. The laps are inter-engaged. The pipe has its side edges fastened rigidly together throughout the length of the first-named lap, leaving the edges at one end free. The two parts of the pipe can be relatively moved to adjust the diameter.

Designs.

BELT.—LOUIS SANDERS, Brooklyn, New York city. The leading feature of this design is found in a peaked frontispiece, connecting the ends of a back section. A ring or chain ornamentation is provided for the frontispiece.

GARMENT-REGULATING ATTACHMENT FOR BELTS.—LOUIS SANDERS. Brooklyn, New York city. The attachment consists of a small plate, the formation of whose body includes a lower transverse section and upright sections connecting with the end portions of the transverse section. A corresponding flange is formed at the bottom of the transverse section. The attachment is easily adjusted and performs its functions efficiently.

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(7905) B. G. J. writes: 1. In a spark coil for a current of 98 volts and 50 amperes, what would be the size of the insulated wire, of the short wires forming the core? A. You may make your spark coil with a core of No. 14 iron wires cut 12 inches long, and annealed by heating red hot. The core should be about one inch diameter. Upon this wind the coil, insulating each layer with brown paper. Use No. 12 copper magnet wire, double covered with cotton. Six layers should give a good spark; more can be put on, if necessary. 2. What is the formula for birdlime? A. For birdlime boil the middle bark of the holly, gathered in June or July, for 6 or 8 hours in water, until it becomes tender; then drain off the water, and place it in a pit under ground, in layers with fern, and surround it with stones. Leave it to ferment for two or three weeks, until it forms a sort of mucilage, which must be pounded in a mortar, into a mass, and well rubbed between the hands in running water until all the refuse is worked out; then place it in an earthen vessel, and leave it for four or five days to ferment and purify itself. Remarks: Birdlime may also be made from mistletoe berries, the bark of the wayfaring tree and other vegetables, by a similar process. Should any of it stick to the hands, it may be removed by means of a little oil of lemon bottoms or turpentine. Use: To rub over twigs to catch birds or small animals. It is said to be discutient when applied externally. 3. Has any number or numbers of the SCIENTIFIC AMERICAN directions for making spark coils, motors or dynamos? If so, what number? A. We have published the plans and descriptions of many dynamos and motors. See SUPPLEMENT, Nos. 161, 600, 641, 759, 761, 783, 844, 865, 720, 793, 1202, 1210. And for coils, see SUPPLEMENT, Nos. 160, 569, 1087, 1124. Any or all of these can be sent you for ten cents each by mail.

(7906) T. L. C. writes: Suppose a cannon was placed perfectly level. When fired, would the ball rise when it left the muzzle or would it commence to drop the instant it left the gun? A. Gravity acts constantly, and the ball commences its downward curve at the instant it leaves the gun.

(7907) O. S. writes: I intend to erect lightning conductors at my buildings; they will be made of two-inch tubing below, reduced to one inch at the top, connected by a heavy copper wire running from the top, of one conductor to the other above the building. A. With reference to lightning rods we advise you to buy our SUPPLEMENT, No. 998, price 10 cents, which will give you much information upon the matter. 1. How high above the building should the conductor and wire be and how far away from the buildings should the conductors stand? A. The conductor should be carried to all high points of the building, and not merely to its highest point. It is not wise to erect very tall pointed rods projecting several feet above the roof. The conductor should be next the building and not stand away from it, and all metallic masses, such as water spouts, should be connected to it; though all authorities are not agreed in regard to this point, the latest opinion is in this direction. 2. Would lead joints do to connect the tubing with, or should the joints be iron? A. Connections may be soldered, riveted or screwed. In whatever way the parts are joined, the joint must be firm. 3. Would four feet in the ground with a lot of old iron at the bottom of the conductors be all right? A. If the ground is permanently wet, yes. The moisture of the earth is the important element, and not the depth. The rod must extend to water, no matter how far that is. 4. Will wood do to hold the wire and conductors to the building, or should I use glass? A. Opinions vary upon this point. We are inclined to think a wooden fastening is as good as any. 5. Will it do to put the ends of the wire inside the tubing at the top and drive a plug in tight? Would this make a good connection? A. No. What has been said above regarding connections, answers this question. Nor should you change to a copper wire. Copper is not considered to have any advantage over iron. A galvanized iron telegraph wire is sufficient if carried liberally over the roof and all high parts of the building. Nor is a two-inch pipe desirable. A one-inch pipe is entirely sufficient. Size is not important. Lightning often leaves a heavy rod and takes to a fine wire on its way to the earth.

NEW BOOKS, ETC.

DIGEST OF UNITED STATES AUTOMOBILE PATENTS FROM 1789 TO JULY 1, 1899. Including All Patents Officially Classed as Traction Engines for the Same Period. Compiled by J. T. Allen, Examiner United States Patent Office. Washington, D. C.: H. B. Russell. 1900. Quarto. Pp. 700. Sheep. Price $25.

The compiler has performed a difficult task with great credit to himself. He has previously compiled a digest of patents for cycles and velocipedes which has been of the utmost possible use, also of seeding machines and implements, plows and attachments, cultivators and wheel plows. All the patents relating to horseless vehicles are included in the portly volume. The patent drawings are reproduced photographically and no drawing is omitted, every sheet being given, which is most important to those who are engaged in inventing along the line of automobile vehicles. The remaining portion is a reproduction of essential descriptions of the inventions, with claims in full, with full data as to the patent, and further there is furnished a complete index to the references cited against the patents while pending as applications by number, name and date, and also the interferences, if any, the parties thereto and the decisions. The index is alphabetical. The patents are arranged chronologically under the heads of spring, steam, gas, air, electricity and gearing, while under the head of traction engines are given all traction engine patents as officially passed upon. There are various indices adding to the value of the book. The automobile patents are continued from July 1, 1899, in the United States Electrical Weekly, which is also compiled by Mr. Allen.

THE GENESIS OF WORLDS. By J. H. Hobart Bennett. Springfield, Ill. 1900. 12mo. Pp. 345. Price $1.65.

SYSTEM OF MEASUREMENTS ADOPTED BY THE NATIONAL ASSOCIATION OF MASTER HOUSE PAINTERS AND DECORATORS OF THE UNITED STATES. New York: The Painter's Magazine. 1899. Quarto. Pp. 60. Price $1.

This book contains a great deal of useful information for the architect as well as for the painter and decorator, giving the result of the labors of the committee appointed by the National Association to formulate a system of measurements of painter's work, which should be thoroughly accurate in every particular. There are six lithographic plates, measuring 16× 0 inches, showing the application of the system to houses of various designs and different interior and exterior details. It is only necessary to measure the work in accordance to the rules laid down, and apply the local price per square yard of plain surface, which is governed by cost of material and labor, to be able to correctly estimate the most complicated job of painting.

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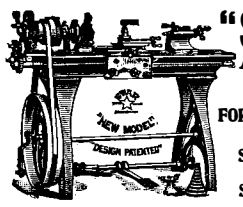

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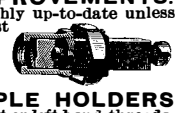

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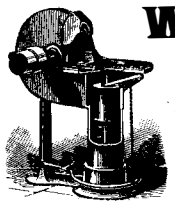

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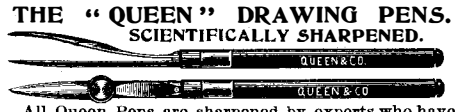

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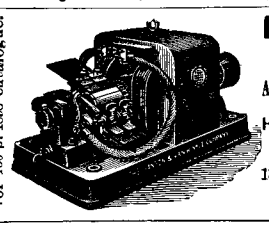

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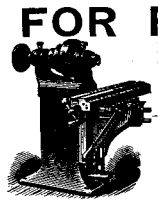

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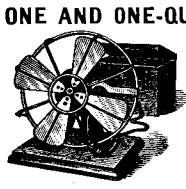

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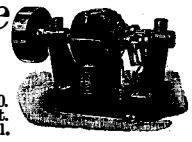

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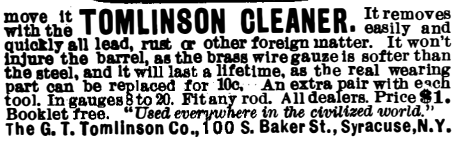

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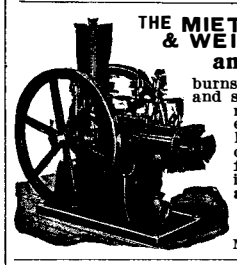

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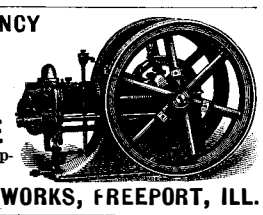

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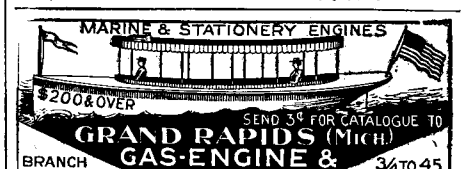

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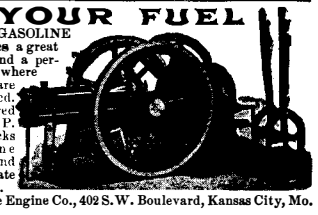

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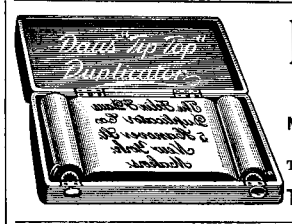

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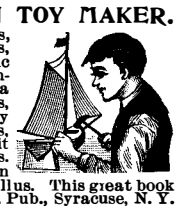

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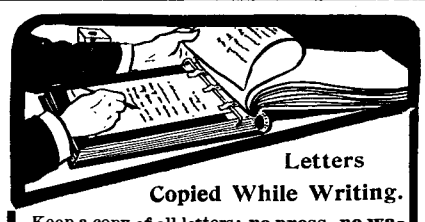

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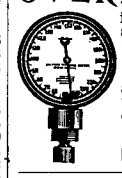

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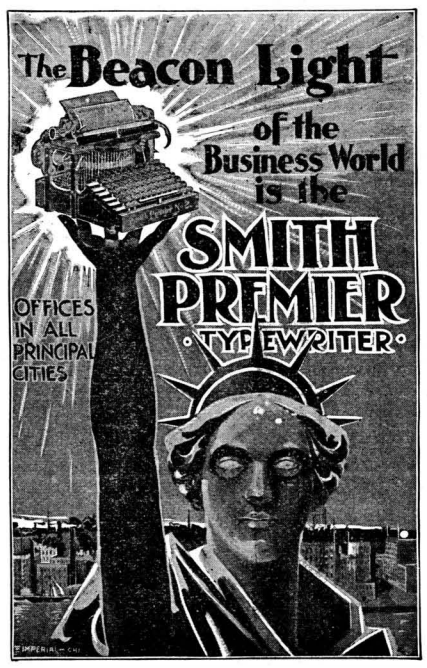

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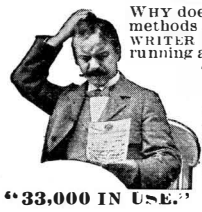

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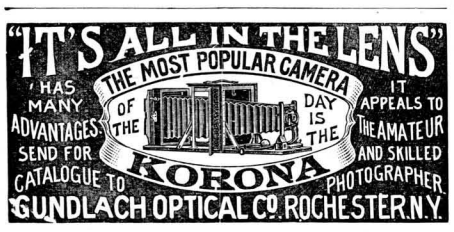
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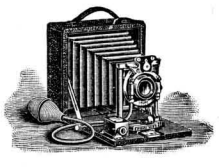

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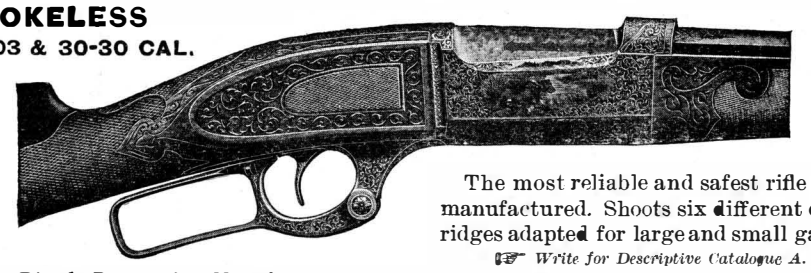

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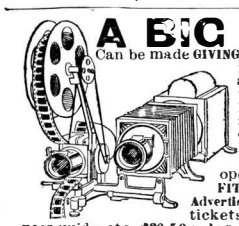

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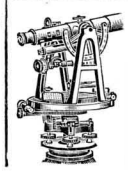

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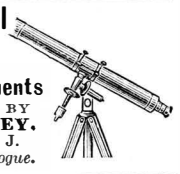

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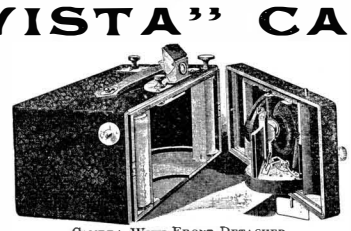

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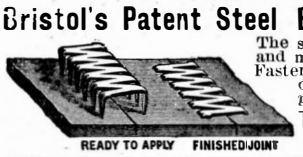

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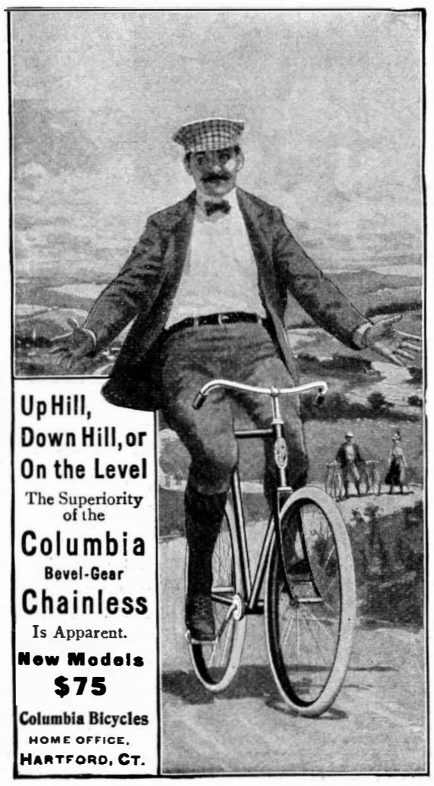

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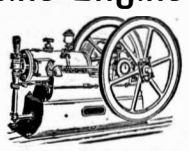

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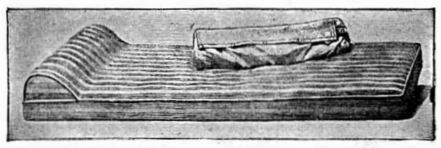

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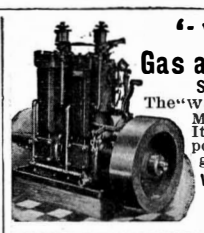

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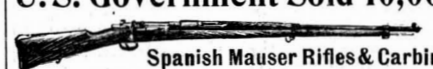

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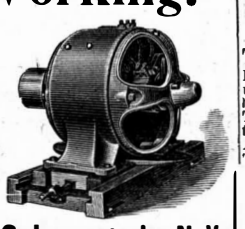

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